

1 BEFORE THE
2 ILLINOIS COMMERCE COMMISSION
3 TRANSPORTATION ELECTRIFICATION POLICY SESSION
4 Tuesday, September 18, 2018
5 Chicago, Illinois
6
7 Met pursuant to notice at 1:00 p.m. at 160
8 North LaSalle Street, Chicago, Illinois.
9
10 PRESENT:
11 BRIEN J. SHEAHAN, Chairman
12 SADZI M. OLIVA, Commissioner
13 JOHN R. ROSALES, Commissioner
14 ANASTASIA PALIVOS, Acting Commissioner
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1 ACTING COMMISSIONER PALIVOS: I'm delighted
2 to welcome you to the Illinois Commerce Commission
3 Policy Session on Transportation Electrification.

4 This session is convened pursuant to
5 the Illinois Open Meetings Act, and our guests and
6 panelists should be aware that a court reporter is
7 present.

8 A transcript of this session will be
9 posted to the Commission's website.

10 With me today are Commissioners
11 Rosales and Oliva and Chairman Sheahan. We do have a
12 quorum.

13 This is our second policy session on
14 the topic of electric vehicles, and today we will
15 dive deeper into the issues surrounding
16 transportation electrification as it relates to
17 commercial fleets and public buses.

18 To emphasize the importance of
19 transitioning towards more electric vehicles in the
20 transportation and fleet industry, I want to
21 highlight just a few statistics.

22 According to the U.S. Environmental

1 Protection Agency, the transportation sector alone
2 produces almost a third of the total U.S. greenhouse
3 gas emissions. This category includes the
4 transportation of people and goods by cars, trucks,
5 trains, and other vehicles.

6 In 2017, the American Public
7 Transportation Association reported that Americans
8 took 10.1 billion trips on public transportation.
9 Last mile delivery services will also become
10 increasingly relevant as customers buy more goods
11 online and expect faster and cheaper deliveries.

12 What do these trends and specifics
13 mean? To me and other observers in the industry,
14 they suggest that there is an opportunity for us to
15 significantly reduce carbon emissions by further
16 developing transportation electrification.

17 Transportation electrification also
18 allows us to make the grid more resilient by charging
19 EV batteries when there is surplus energy and
20 discharging the power back into the grid when it is
21 most needed. This will become especially
22 advantageous as we continue to increasingly rely on

1 renewable energy.

2 Today, we will discuss the
3 developments in the electrification of commercial
4 fleets and public buses as well as the benefits and
5 barriers of this transition. We will also have a
6 chance to explore the current legal and regulatory
7 landscape surrounding transportation electrification
8 in Illinois and how it compares to other states in
9 the country.

10 These policy sessions serve to create
11 respectful and necessary conversations around topics
12 of interest to the Commission, so please keep that in
13 mind as we move through the presentations and
14 conversations.

15 Thank you again for being here with
16 us today and for your interest in this topic.

17 I'd like to quickly recognize
18 Commissioner Trombold from the Ohio Public Utilities
19 Commission, and thank my legal and policy advisors,
20 Emily and Ritta, for helping put together this
21 session. It's no easy task.

22 Without further ado, I will pass it

1 off to our first moderator, Tanya Gutierrez, who will
2 introduce our first group of speakers.

3 Tanya?

4 MS. TANYA GUTIERREZ: Thank you,
5 Commissioner Palivos.

6 As the Commissioner said, my name is
7 Tanya Gutierrez, and I am legal and policy advisor to
8 Commissioner Rosales and moderator for this first
9 panel titled, "Where Technology is Driving Us:
10 Service, Delivery, and Infrastructure of the Future."

11 The format of the panel will consist
12 of brief presentations by each of our panelists
13 followed by a series of questions. If time remains
14 at the end, we will take questions from the audience.

15 Before I begin, I would like to
16 introduce our panelists.

17 First, we will hear from David
18 Peterson, Director of Fleet Solutions at ChargePoint.

19 Next, we will hear from Austin
20 Hausmann, VP of Engineering at Chanje.

21 Following Austin, we will hear from
22 Kevin Vincent, Vice President of Government,

1 Regulatory, and Safety Affairs at Workhorse.

2 Then we will hear from Jon Walker,
3 Transportation Policy Manager at Lyft.

4 And last, but certainly not least, we
5 will hear from Heather Flanagan, North American
6 Marketing Manager for EV Infrastructure at ABB.

7 Please join me in welcoming our
8 panelists.

9 (Applause.)

10 MS. TANYA GUTIERREZ: David, you're free to
11 begin when you're ready.

12 MR. DAVID PETERSON: Thank you. I'd like
13 to thank the Commission for inviting ChargePoint to
14 speak today.

15 As mentioned, I'm David Peterson,
16 Director of Fleet Solutions at ChargePoint, and I'm
17 very pleased to be sharing our insights here today on
18 charging technology for electric vehicles.

19 I would just like to make a quick
20 footnote that just last week at the Global Climate
21 Action Summit, our CEO made a commitment along with
22 other business and government leaders that we will

1 commit to 2.5 million electric vehicle charging
2 stations or ports by 2025. Thank you to my policy
3 counterpart.

4 So one of the things about
5 ChargePoint is we take a very broad perspective of
6 the market. We're interested in charging any and all
7 electric vehicles, both on road and off road, and as
8 it pertains to fleet, we are the only company that
9 really takes this broad perspective looking at all
10 electric vehicles.

11 Quick background on ChargePoint, so
12 you know where we're coming from. We were founded in
13 2007, primarily focused on the light-duty market,
14 because, really, our market is tied to vehicle
15 availability.

16 So over the years, we have
17 progressed, and we are now into the fleet charging
18 market. We have over 5,000 fleet stations deployed,
19 and that's of the 50,000-plus stations we have
20 deployed across the country, including Canada and
21 Europe.

22 We support over 150 fleets today. As

1 I mentioned, we're active in charging public sector
2 vehicles, logistics and delivery, car sharing,
3 transportation network companies, public transit, and
4 vocational vehicles, including off road. So when I
5 mean broad, I do mean broad in terms of the
6 technology we use to charge electric vehicles.

7 And so just a quick definition when
8 we think about fleet and commercial. We have
9 everything from light-duty trucks and vans to
10 heavy-duty vehicles often defined by gross vehicle
11 weight ratings, so Class 3 through Class 8. We have
12 school buses, we have transit buses, vocational
13 vehicles like garbage trucks, and even off-road
14 vehicles like yard trucks and forklifts.

15 So when we think about a charging
16 infrastructure, we need to think about how a customer
17 is going to charge all of these vehicles. We don't
18 simply take the view of this customer is deploying
19 some medium-duty vans, for example, and that's all
20 that they will be deploying. We really take a longer
21 view of what a facility will end up needing to charge
22 over time.

1 In addition to that, we really take
2 an ecosystem perspective, because we are now in our
3 customers' business model. Charging for fleets is
4 not an amenity. It is actually core to that
5 customer's operations.

6 So we really look to align with
7 whatever that customer is doing so it's seamlessly
8 integrated, and I think this is an important
9 perspective to take when looking at charging
10 solutions for fleets.

11 So some of these things are performed
12 by different people. They can be performed by a
13 single person. But it's important to understand that
14 a fleet manager today is thinking about vehicle
15 procurement, managing that vehicle, disposing of that
16 vehicle. Managing how that vehicle is put into use,
17 so is it assigned to routes, is it assigned to
18 drivers. So the vehicle -- how is it being managed
19 in that fleet; right? There's some software.
20 There's some management function there.

21 And then there's the fueling system,
22 which can be on-site fueling. It can be managed with

1 a fuel card for en-route fueling or both.

2 But the considerations when it comes
3 to electric fuel tend to be quite different, and the
4 way we see it is what we provide is fuel management
5 for electric fuel. And this has to be seamlessly
6 integrated with the way fleets think about fuel
7 today.

8 And so we layer on top of what
9 systems fleets have, and at the core, ChargePoint has
10 charging stations both its own and third party, that
11 it can provide to customers, and it has a software
12 layer that manages those charging stations. And this
13 is the key to being able to integrate with different
14 systems.

15 So that software layer that allows us
16 to communicate with the charging stations and
17 communicate with other systems to manage fleets is
18 what really delivers value for that fleet. So they
19 now can have seamless management, everything from
20 integration with dispatch to, what is really
21 critical, making sure the stations are operational
22 once they're installed.

1 In order to do that, we have to take
2 customers through a process. So no fleet charging
3 system is the same. You could take two delivery
4 fleets or two school bus fleets or two transit
5 fleets, even two different locations for those
6 fleets, and the charging system could be very
7 different. It depends on what they actually have
8 going on at the site, what the electrical capacity
9 constraints are, and what other objectives that fleet
10 may have, operational and such.

11 And so something we've seen -- we've
12 seen this in incentive programs, and we've seen some
13 of this with utility programs, is that they often try
14 to tag a specific charging station or a specific
15 charging power to a type of electric vehicle based
16 either on the size of the battery or the job that
17 it's intended to do.

18 And, for example, there was one
19 utility filing that we saw very recently that had a
20 direct linear relationship between the size of the
21 battery and the amount of power that you would need.
22 This is kind of a -- it's just an inaccurate way of

1 looking at the world, because you could have the same
2 medium-duty electric vehicle running 24/7 operations,
3 let's say, at an airport, and at the same time, that
4 same vehicle could be dwelling 12 hours at a
5 distribution center overnight. So those require
6 different power levels in order to design an
7 efficient charging system.

8 So the first thing we want to do is
9 really look at what are the minimum power levels that
10 need to be delivered to that fleet or to those
11 vehicles in that fleet to minimize cost. And that's
12 sort of a first order objective that we have.

13 And so it takes a variety of charging
14 stations to deliver an optimal solution depending on
15 what the objectives are of that fleet. So
16 ultimately, this all has to come together in some
17 optimal way. So software is often at the center of
18 that, and that is core to what we offer at
19 ChargePoint is a way to integrate different systems.

20 So the fleet systems, the utility
21 signals that we can get, any sort of microgrid for
22 on-site generation storage, as well as vehicle

1 telematics, we can combine all of that and optimize
2 for what a fleet is trying to accomplish, which is
3 basically get to the lowest cost electrons in the
4 most reliable and predictable way.

5 So a couple of examples. I didn't
6 spend a lot of time on the process, but I think it's
7 important to at the outset understand that putting
8 vehicles into service is not as trivial as simply
9 doing some calculations on the back of an envelope.
10 We worked very diligently with a consultant and a
11 transit agency to actually run simulations for a
12 specific bus fleet, and what we found was the routes
13 that were initially selected were not suitable -- or
14 a handful, as you see, the red Xs, they were not
15 suitable for the electric buses that they wanted to
16 put into service.

17 It's important to look at things like
18 work flow and to do a site analysis, because of the
19 parking configurations and how drivers, perhaps,
20 access vehicles. Different parking configurations
21 may actually lead to different charging installation
22 solutions, so overhead, fast charge, or pedestal

1 mount installations.

2 And lastly -- and this is really core
3 to a network charging solution is the ability to
4 shift load and flatten load. And what that means is
5 basically reduce the kilowatts necessary to charge
6 that fleet and the kilowatt hours and the cost of
7 electricity to charge that fleet.

8 This is an example of a distribution
9 facility, and this is my final slide. This is an
10 example of a distribution facility, and the lines you
11 see there in orange are the load profile of that
12 facility, and our task was to figure out how to
13 maximize the number of delivery trucks that we could
14 install in that facility at the lowest cost.

15 And so what we found was -- and you
16 see there at the bottom, there's a demand charge, a
17 pretty hefty one of roughly \$14 per kilowatt that if
18 we exceed that maximum peak, basically every
19 additional kilowatt would be about \$14.

20 So what we found was the maximum
21 number of vehicles that we could get into this fleet
22 without any distribution upgrades were six, and that

1 avoided about \$10,000 dollars and avoided
2 distribution panel upgrades. We also avoided \$556 a
3 month in demand charges, and this resulted in overall
4 fuel savings of 50 percent for that fleet, and this
5 is on the optimized solution. So 50 percent savings
6 versus what the fleet was paying at the time of \$2.41
7 a gallon.

8 So this is actually the way we
9 approach pilots, because this is the lowest cost way
10 to approaching a pilot. The alternative is simply to
11 put in some trucks, throw in some charging stations,
12 and let them power up, but that means you create this
13 peak, an unnecessary peak, that would have resulted
14 in these upgrades and that would have resulted in
15 these demand charges.

16 And so this is the value or part of
17 the value that customers see moving to a network
18 charging solution in addition to the integration with
19 their fleet management systems. That way, they can
20 roll out a seamless infrastructure with their
21 electric vehicles.

22 Thank you.

1 MR. AUSTIN HAUSMANN: Thank you, David.

2 So I'm not sure if you were told why
3 you were going to be here, but to hear an engineer
4 talk about policy, I don't think we would have as
5 many people in this room today. So bear with me as I
6 stumble through this, because I was a replacement for
7 our original speaker, Ian Gardner, who was caught up
8 on the West Coast.

9 So what I want to talk to you about
10 today is a little bit about who Chanje is and why
11 we're here, but also talk about some of the learnings
12 that we've had over the years and some of the things
13 that we feel the Commission can do based on our
14 experiences on the West Coast.

15 So Chanje is in all-electric OEM. We
16 really focus on anything that touches the last mile
17 in the commercial delivery space. So think parcel
18 and package, deliveries to your house, deliveries to
19 your business, a hundred starts and stops a day, and
20 really getting that package from its last mile
21 location at the warehouse into the final delivery
22 spot.

1 So when we set out to really disrupt
2 this space a few years ago, we realized that this had
3 to be done from the ground up. One of the things
4 that the industry has seen for quite a long time is
5 vehicles that were electrified based on an existing
6 diesel or gasoline chassis. And what we found is
7 that you really don't maximize the advantage of EVs
8 by retrofitting an existing solution. You're force
9 spinning the problem, if you will.

10 So when we started out to do a clean
11 sheet design, we realized that the efficiency gains
12 were actually what were needed to tip adoption in a
13 real way and really tip over the economics, so we'll
14 walk through that as well.

15 The other thing that we've taken to
16 heart is when we approach these -- similar to all of
17 the work David talked about, charging is really
18 complex for them, and this is an evil necessity of
19 moving packages, and they don't fully appreciate the
20 complexities that David outlined, and oftentimes,
21 they're looking for us to provide those solutions.
22 So we've taken a more holistic approach than just

1 putting vehicles in market.

2 So to touch a little bit on our
3 product, our flagship model is a Class 5 electric
4 delivery van. So when you see that picture, it looks
5 more like the European-style panel vans that we're
6 all accustomed to, but in reality, it's much larger.
7 So think of a large step van that the parcel delivery
8 companies use.

9 I think one of the things that
10 differentiates this platform is it's actually built
11 on a commercial truck chassis. A lot of times in
12 this industry, particularly as we see Amazon starting
13 up, they're cramming a lot of packages and a lot of
14 payload into vehicles that weren't really meant to be
15 designed for long-life commercial applications.

16 And I think what we've realized is
17 that by electrifying that platform, you really do get
18 the best of both worlds. So you can haul a lot of
19 payload, a lot of cargo volume, but the fuel
20 efficiencies of EVs at 50-plus miles per gallon means
21 you don't have to compromise by going to a smaller
22 vehicle for fuel efficiency's sake.

1 As I mentioned, and I won't go into
2 the detail because I think David covered it
3 brilliantly, is there are a lot of complexities that
4 happen behind the scenes to make sure that electric
5 vehicles are ready every morning when they go on
6 route and that we're doing it with as efficient a
7 model as possible.

8 This can get incredibly complex, and
9 when we approach customers, we realize not every
10 given site is the same. So it could be the same
11 amount of vehicles with the same customer, even in
12 the same regions, that those depots can be uniquely
13 different based on whether it's a lease or an own,
14 based on the layout of those facilities, based on
15 parking lot capabilities.

16 So we take a dedicated approach to
17 looking at each one of those depots on an individual
18 basis and making sure that we're very diligent in
19 offering a solution that meets their needs.

20 So one of the things I wanted to
21 focus on today was some of the programs that work
22 really, really well that we've been a part of and

1 have the advantage of supporting our business with.
2 The two differentiators on the left -- these are all
3 California state programs -- are the HVIP program
4 that exists, which is effectively a voucher
5 redemption program, as I'm sure many of you are
6 aware.

7 But what I wanted to do was talk
8 about how that differs and how it has different
9 applications between typical grants. So the HVIP is
10 a voucher-based program, and vouchers can be claimed
11 at the point of sell, and then they're redeemed at
12 the point of delivery. This is effectively a cash
13 incentive on top of the vehicle purchase.

14 And one of the things that works
15 really well about HVIP is that it's a multi-year
16 program that covers vehicle deployments in low
17 emission aspects. So that could be everything from
18 natural gas to electric delivery vehicles to electric
19 buses.

20 And as the program sits right now in
21 our category, it's between an
22 80 and 90 thousand dollar incentive on top of the

1 vehicle purchase price to really encourage fleets to
2 put vehicles out there that are zero emissions and
3 making the most impact.

4 Now, how that differs from the
5 typical grant in projects and development is it's
6 really difficult for fleets to make multi-year buying
7 decisions based on grants. It's not often that you
8 find a grant timeline that perfectly lines up with
9 the procurement cycle or technology development, and
10 trying to force fit all of those together at a given
11 time and really gain widespread adoption is
12 challenging at best.

13 Where grants and projects
14 typically fit in best are on R&D and pilot
15 initiatives where it's typically lower volume, you
16 aren't as constrained by the timelines that are
17 associated with that, and you have some more
18 flexibility in deployment of a technology across a
19 given customer.

20 Off to the right, I think, are two
21 things that really impact the infrastructure side.
22 So the LCFS program is effectively fueling credits

1 for low carbon vehicles, and effectively, that is on
2 a per energy unit basis. So when we fuel vehicles in
3 certain areas in certain conditions, we get credit
4 for putting that energy into a low carbon vehicle; in
5 our case, a zero emissions vehicle.

6 So those are used as credits for the
7 actual energy consumption, itself. And where that
8 differs from the bottom right, which is the favorable
9 charging rate, those are against the rate structure
10 when used to fuel EVs or low carbon vehicles, such as
11 hybrids.

12 So now I want to shift a little bit
13 and just talk about some of the different adoption
14 perspectives that we've seen both as an OEM and from
15 a fleet perspective. So I think we're seeing kind of
16 four macro trends that are really driving adoption in
17 this space as well as the pass car space.

18 Urbanization -- and it's kind of
19 difficult to read some of those stats up there, but
20 we're seeing this trend of people moving from rural
21 areas into urban areas, and we see that continuing
22 for the near future. What this is doing is

1 congesting areas with population as well as emissions
2 in our immediate impact area, which is the last mile.

3 So as we see that continue to trend,
4 we see an inverted trend of EVs becoming more
5 prevalent there as well.

6 The other aspect that we're seeing is
7 low emission cities, and I think this is probably
8 more on a global basis where you've seen city centers
9 actually mandate that there are selected delivery
10 times available, or if you're not zero emission, you
11 can't actually get into the city center.

12 And this has some far-reaching
13 impacts for our customers, because if they can't
14 deliver their product to the center, it really
15 disrupts their business, particularly those that are
16 dedicated to getting packages there at a specific
17 time.

18 The other is the introduction of
19 autonomous, and we see this having large, sweeping
20 impacts in the last mile space not only for driver
21 safety and driver retention, but as well as offering
22 overnight deliveries or safer modalities when you

1 have higher urban areas where our vehicles are
2 actually purposed.

3 The other is corporate
4 sustainability. We've seen the tipping point in
5 corporate sustainability where large Fortune 500
6 companies are really mandating large solutions that
7 are impactful. We've seen a lot of timelines out
8 there, 2020, 2025, but I think the general trend is
9 that customers and corporations are demanding a
10 different level of corporate sustainability, and
11 transportation is one of the areas that you can
12 impact that really quickly.

13 From a fleet perspective, I think
14 there's a few things that are covered in this chart
15 that are really driving adoption. The orange line
16 there is the total cost of ownership of our
17 equivalent vehicle since 2008, and as you can see,
18 that line has come down quite a bit over the past ten
19 years.

20 So on the EV side, that's largely
21 driven by battery costs. We've seen in the last ten
22 years battery costs come from about \$1200 a kilowatt

1 hour to less than \$200 a kilowatt hour. So our
2 product, at 100 kilowatt hour battery packs, you're
3 looking at a savings of almost \$100,000 off the
4 capital purchase price of a vehicle just in the last
5 ten years.

6 And what we have really seen by doing
7 a ground-up platform is where the fuel and emissions
8 savings come in. So EVs with fewer moving parts are
9 inherently less maintenance intensive, and you don't
10 have oil changes, you don't have transmission
11 flushes, you're not dealing with diesel exhaust
12 fluid, and on a per mile basis, we've seen about a
13 70 percent reduction in those maintenance routines.

14 In the cases where fleets are doing
15 this maintenance inhouse and are trained, that can be
16 as high as 80 or 90 percent just based on the
17 material charges.

18 The other thing that we've seen is
19 how volatile diesel fuel prices have been over the
20 past ten years. You see that plateau there from
21 about 2011 until 2015 where the average price of
22 diesel was approaching \$4 a gallon. And it starts to

1 fall off in the middle, but it's picked back up
2 recently.

3 The other thing that we've seen is
4 with increasing emission standards, vehicles are
5 getting more costly on the diesel side to make sure
6 that you're meeting those standards. So in addition
7 to the fuel volatility, we're seeing an increasing or
8 an inverted trend to EVs where diesel vehicles are
9 actually getting more expensive, and EVs are getting
10 cheaper to operate and cheaper to own.

11 Thank you.

12 MR. KEVIN VINCENT: Hello. My name is
13 Kevin Vincent, and I'm with Workhorse.

14 Let me get my slides up here. There.
15 That's me.

16 Workhorse, if you haven't heard of
17 us, we're a small company located in Cincinnati with
18 a factory in Indiana. We've only got 125 employees,
19 but we are all about electric trucks.

20 The company has been in business for
21 more than ten years, and we've always been doing
22 electric vehicles.

1 Where we're positioned now is
2 focussing in the medium-duty truck space, and we've
3 got -- well, first of all, let me go through my
4 slides.

5 We always put on our slides our
6 disclaimer, because we're a publicly-traded company.
7 Even though we're a tiny company, we do have
8 publicly-traded stock, so we put this disclaimer on
9 forward-looking statements.

10 All right. This is the slide I
11 want to show you about what we do. What Workhorse
12 does is build electric vehicles and a couple of neat
13 drones, and I'm going to talk about two or three of
14 these.

15 The first one on your left is the
16 traditional vehicle we've been building for the last
17 several years, which is a medium-duty, step van,
18 truck, similar to the Chanje vehicle, and that's what
19 we have done in the past, but we're moving on with
20 some other vehicle platforms.

21 The next vehicle I'm showing there is
22 the USPS vehicle, because we are finalists on that

1 procurement to replace the ubiquitous postal service
2 delivery vans, and we're hopeful we're going to win a
3 contract with the postal service, and if we do that,
4 it will be huge for our little company, and
5 hopefully, we'll find out about that pretty soon.

6 The next thing that we have a lot of
7 publicity on, which I'm actually not going to talk
8 about today, is the pickup truck, which next year,
9 sometime in the future, we're going to start
10 producing an electric pickup truck.

11 What I want to focus on mostly is the
12 last vehicle on the right, which is our N-Gen
13 delivery van, and there's two vehicles up above.
14 There's two drones. There's one on the right. It's
15 a manned drone. I'm not going to mention that
16 either, because I want to talk about deliveries. But
17 I will talk about the drone on the left, which is our
18 small delivery drone. So I'll go into each of these
19 as we go forward.

20 This slide is historical, just
21 talking about the development of the EVs, how ten
22 years ago it was just tiny, little ideas of doing

1 electric vehicles, and the focus is that today
2 electric vehicles are certainly the beginning of a
3 reality that all these companies that are here today
4 are involved in, but the public is going to be seeing
5 more and more of, and we're really at the crest of a
6 wave that's about to hit us.

7 Now, this slide, the compelling fleet
8 economics is really the most important slide to
9 Workhorse. It's similar to the slide that Austin was
10 showing with the total cost of ownership.

11 This is based on our step van,
12 probably about a year old calculations we had done
13 which shows the customers that looking at the total
14 cost of ownership, you're going to pay for the
15 upfront price of getting a lithium-ion battery
16 instead of a diesel engine after two and a half years
17 of operation, and fleet owners are buying fleets that
18 they know they are going to operate more than two and
19 a half years, generally much longer than that.

20 So it's pretty easy to see by the
21 normal length of time that you're operating your
22 fleet, the only thing that makes good economic sense

1 is to get into electric platforms when they're
2 available. When they're available is a big issue
3 because there's not much on the market right now.
4 There's several companies, but the volumes just
5 aren't there. What we're trying to do is ramp up to
6 meet the demand that that chart creates.

7 We have some real world experience,
8 including some real world experience here in Chicago
9 with -- that's our bigger -- I think it's Class 4,
10 maybe it's Class 5, van or truck. And the quote down
11 there is really a great quote, because it talks about
12 the experience -- I wish I could read it.

13 Essentially, the point is the drivers
14 would rather drive an electric vehicle than with
15 diesel engines. They don't have the awful diesel
16 smell. They don't get dirty. They like the quiet
17 vehicle operation.

18 So once you get the delivery drivers
19 driving electric, they don't want to go back. It's a
20 much better experience for the delivery companies
21 from the drivers, and we found that just universally
22 across all the fleets that have purchased not just

1 our vehicles, but other electric vehicles.

2 So I mentioned the postal service
3 procurement. I don't want to dwell on this a lot,
4 but it is going to be very big for Workhorse if we
5 end up winning that contract. That's the largest
6 fleet in the world. We're one of the five finalists
7 for that procurement, and there's some word around
8 here somewhere. Hopefully, we will have a piece of
9 that.

10 And there's our pickup truck which,
11 again, is -- it's a work vehicle, but it's not the
12 delivery solution that I want to talk about today,
13 which is the N-Gen electric van. The N-Gen electric
14 van, we're going into production this year. As a
15 matter of fact, right now, we're in the midst of
16 producing our first several vehicles for customers.
17 We have some prototypes we've been operating already
18 this year in California, and we did the design
19 earlier last year.

20 But we're going -- we're beginning
21 production on this. UPS has already purchased a
22 thousand of our vans. So we are focused, of course,

1 on meeting that -- meeting that customer demand, but
2 there's lots of other customers that are interested
3 in purchasing this van.

4 And this van represents, really, the
5 solution that all sophisticated delivery fleets
6 understand makes the most economic sense for urban
7 delivery.

8 If you're in rural delivery routes,
9 you might be stretching past the range that you can
10 approach with electric vehicles, so you may need to
11 have some other solutions.

12 But in urban delivery where you have
13 stop-and-go traffic and relatively limited miles
14 range, a 100-mile range van, that's 100-to-110-mile
15 range depending upon how many hills you have, that's
16 going to meet most companies' urban delivery routes,
17 you do it all electric.

18 And when you're burning electricity
19 as opposed to burning fuel, it is considerably
20 cheaper. Austin went over the numbers. That is the
21 smart economic decision for every city to be
22 expecting their fleets to be moving to, and for every

1 state to be supporting for their urban environments,
2 because you avoid all the -- not just the climate
3 change impacts of burning diesel, but you avoid the
4 terrible particulate matter problem in sometimes the
5 poorest neighborhoods when you're spewing out diesel
6 exhaust in order to make your delivery.

7 So for many different reasons, the
8 economic sense of the customer, that's going to be
9 the cheapest way for them to do their deliveries, and
10 for the communities where those deliveries are
11 happening, electric delivery is the future solution
12 that makes by far the most sense.

13 We're trying to help enable that.
14 Obviously, that's our business model. But it should
15 be, we think, the business model that communities
16 ought to be demanding.

17 Okay. This is another point, again,
18 similar to the numbers Austin was doing. When you
19 compare the cost of operation, the total cost of
20 ownership of diesel or any internal combustion engine
21 delivery van and all electric delivery van, it's
22 cheaper.

1 I mentioned UPS bought a thousand of
2 our vehicles, and then I want to talk about this
3 solution. I have a video -- did you have a video
4 loaded up? Did I give that to you? I'm unable to?
5 Okay.

6 There's a neat video. Go to our
7 website, and you can see this drone in operation off
8 of our delivery vans. But the idea is if you combine
9 autonomous delivery with a drone with the operation
10 of an all-electric delivery van, you can get an ideal
11 solution for what the delivery companies call the
12 left-turn problem. So when you're making deliveries,
13 UPS, Amazon, DHL, all of them always try to make all
14 right turns in their entire route, because left turns
15 take longer. You have a lot of dead time when you
16 make a left turn.

17 So if you can assign your left-turn
18 deliveries to a drone, launch the drone off of your
19 truck and have that go to the house instead of making
20 a left turn, you can avoid a lot of wasted fuel, a
21 lot of wasted time.

22 So the delivery companies are very

1 excited about the possibility of having a drone that
2 you can launch autonomously ideally to go make a
3 delivery in a delivery route that would be
4 inefficient for the vehicle to operate on.

5 And again, if you go to our website,
6 Workhorse website, you can see a video of that
7 operation.

8 It mounts on top of the vehicle, and,
9 also, I just want to mention, right now, we are
10 demonstrating this with an FAA permit in Cincinnati
11 right now. We are doing delivery routes. It's not
12 the final delivery plan, because right now, it has to
13 be line of sight as we're doing the test. So the
14 vehicle has got to be stopped while it watches the
15 drone make the deliveries.

16 But combining those two together will
17 be an ideal solution for how to limit the congestion
18 and limit the problems that are caused by too many
19 delivery trucks spending too much time in making
20 their routes.

21 And I guess that will do if for me.

22 Yes. Thank you.

1 MR. JON WALKER: All right. Hello,
2 everyone. I'm Jon Walker. I'm a transportation
3 policy manager at Lyft, and I manage our policy
4 as it relates to electric vehicles and some other
5 things related to city design, public transit,
6 et cetera. So excited to be here. Thank you for
7 having us.

8 I want to just briefly go over a
9 broader picture, and I want to get into the fun EV
10 stuff. Lyft is thinking very hard about the future
11 of mobility. We're not interested in just being a
12 tech-enabled taxi company, and we have broad and
13 long-term goals to be electric, autonomous, and
14 multi-modal.

15 I'm from Denver, and we just launched
16 scooters in Denver. They're very fun. You take
17 Divvy in Chicago. We are partnered with Divvy, so
18 we're going to become a multi-modal transportation
19 company one stop shop in the app.

20 So just really quickly, I want to set
21 the stage a little bit. So all of you know if you've
22 driven anywhere in Chicago, this is what it looks

1 like coming into the city. This is 2013. I lived in
2 Chicago in 2013. I did this commute for about six
3 months before I almost lost my mind.

4 We all know what it's like, what it
5 was like, and what it's still like, and this is
6 because five, six years ago, 86 percent of Americans
7 commuted in a car and only five percent in transit
8 and less than one percent on bikes. Not as many
9 people work from home as use transit in this country,
10 which is really unfortunate, but personal cars
11 dominate the country in terms of transportation.

12 There's been a lot of hay made about
13 Lyft and Uber and these new transportation companies
14 that are coming in and changing this pie in some way,
15 so let's take a look. So here is before Lyft and
16 Uber. There's after Lyft and Uber. So it didn't
17 change at all.

18 (Laughter.)

19 MR. JON WALKER: This is last year. I
20 think if people want to tell you we're the cause of
21 congestion, I think you can sell them a bridge.
22 Because we're less than one percent of all the MT in

1 this country. Even in major areas when we look at
2 the numbers, even at peak times, we're no more than 4
3 percent. That's us plus Uber.

4 The reason for that is people drive.
5 The other reason for that is our bread and butter is
6 nighttime. It's bar time. It's restaurant time. We
7 are getting more into the commute space, but that's
8 where we heavily rely on our shared product, our
9 pooled product.

10 So I just wanted to set the stage,
11 because what does that mean? It means our system is
12 completely broken, and I'll get into how EVs address
13 this, but vehicles are underutilized. They sit
14 around parked in our cities 95 percent of the time.
15 They're the second highest expense for an American
16 family, the highest expense for many low income
17 families. In Chicago, it's pretty stark that -- the
18 number of families that the number one expense is a
19 car, which is crazy.

20 They're dirty, so we've got over a
21 gigaton of co2. They're inefficient. If we have any
22 physicists in the room, less than one percent of

1 total energy goes to moving people, which is what
2 we're supposed to be doing.

3 And it's a poor use of land. We have
4 a billion parking spaces in the country. We would
5 increase -- 33 percent of the downtown core of
6 Chicago is used for parking. That's terrible.
7 Imagine what we could do with a third more downtown
8 Chicago.

9 And they're dangerous. We lose a
10 million people in the world, and we lose 40,000
11 people in the U.S., and this number is disturbing on
12 the safety part, because despite the advances in
13 safety technology, it's picking up. So we've reached
14 the limits of what vehicle safety can do when you
15 have people driving into each other.

16 So that parking -- so we could pave
17 Connecticut with all of our parking spaces. It's
18 terrible.

19 So this is where I'm excited to work
20 at Lyft. We are growing rapidly. You can see, we're
21 still less than one percent of all VMT, but we're
22 growing 40 percent year over year.

1 And this one's a little hard to read
2 here, but something interesting that's happening,
3 when I joined Lyft, I wasn't a big believer in
4 pooling. I didn't think strangers would pool. I
5 thought maybe college kids with ramen money would
6 pool, but that is not the case. We're at 40 percent
7 Lyft line requests in some of our best markets, and
8 it's growing like crazy. We have a target to hit 50
9 percent of all rides have strangers pooled together
10 by 2020, and we would like to work together, we
11 think, in partnership with states and cities and
12 folks like you in the room, we could hit 60, 70
13 percent shared rides.

14 One thing that's interesting, I don't
15 want to make a causation correlation argument,
16 because people make that against us sometimes, but
17 what I will say is our best market, our highest per
18 capita market, the number one place we have vehicles
19 is San Francisco, and congestion went down last year
20 by 5 percent according to INRIX, and this doesn't get
21 reported because the negative story about Uber is
22 always good fodder for the papers, but we think we're

1 turning the corner in some of these cities, and so we
2 want to continue to work together to turn that corner
3 faster.

4 What does this mean? This means that
5 what we're going to see in the next few years is
6 personal vehicle demand plummet, and that's really
7 interesting for a lot of reasons. It's interesting
8 for electric vehicles, too. I promise I'm getting
9 there.

10 What this means is that personal
11 vehicles are plummeting. You probably saw, Ford is
12 no longer going to make cars. I'll say that again.
13 Ford is no longer going to make cars. If you would
14 have said that three years ago, people would have
15 said, you're insane, but no one is buying cars
16 anymore. People are shifting to an SUV for a family
17 car, but what we're going to see in the next few
18 years is the bottom fall out of the car market and of
19 the used car market as we see people move to mobility
20 services.

21 My pie got messed up here, so I
22 apologize, but this is from SUMC, Shared Use Mobility

1 Center. Some of you might know Sharon. But what she
2 found when she looked at this in Chicago and other
3 cities is that people that take Lyft tend to take
4 transit more. They tend to walk and bike more. So
5 this pie is really going to change.

6 So autonomous was mentioned. We are
7 working very hard on autonomous. We are working on
8 what some people are calling the three revolutions.
9 So shared vehicles that are electric power trained
10 and that are powered by autonomy. With those three
11 things together, we can undercut personal vehicles in
12 terms of cost, safety, convenience, emissions,
13 everything. So we can be cheaper, better, faster,
14 more, and that's when you're really going to see
15 people switch away from driving.

16 So we have our own lab in Palo Alto.
17 We hired up some top talent from other companies. So
18 we started later than maybe Google, but we're not
19 starting from ground zero. And then we're partnered
20 with the top companies in the world. We're partnered
21 with Waymo. We're partnered with Aptiv, NuTonomy,
22 and Jaguar Land Rover.

1 I want to talk about -- okay. I'm
2 here.

3 The dynamic duo here today. So this
4 was -- I got in a Bolt last week in San Francisco.
5 It was really a sight, so I took a picture with it.
6 But it was a Lyft line shared ride in a Chevy Bolt.
7 That's how we win the game in terms of climate
8 change. It's how we win the game in terms of
9 congestion. And we are very actively working to do
10 this.

11 So why do we care about EVs? Our
12 chart doesn't look as good as a 20-year truck chart,
13 but this is our chart on EVs. We have maybe a five,
14 ten year view on the vehicles, and even then, when we
15 look at our fleet and what it's going to be, we're
16 talking about 200 billion in total fleet savings in
17 about five or ten years.

18 So we're very interested from a money
19 perspective, and we're very interested from a climate
20 perspective.

21 We also made some big announcements
22 at the climate summit in San Francisco, totally

1 carbon neutral operations, including everything
2 that's electric buildings, vehicles, scooters,
3 E-bikes. Everything of that is going to be powered
4 with renewable electricity, and then carbon offsets
5 for every single ride. So when you take a Lyft ride,
6 it's carbon neutral.

7 That's not as good as EVs. So we
8 want to start now with offsets, and we're going to
9 get to renewably powered electric vehicles. How
10 are we going to do that? This is pretty brand new.
11 So I'm excited to present this today. That's why
12 it's not a very glossy slide. But we are spinning
13 up a pilot right now. We're picking two major
14 American cities to put on the order of hundreds of
15 vehicles.

16 We have a program right now in
17 Atlanta where the utilities are paying our drivers to
18 drive EVs, so likely, one of the cities will be
19 Atlanta. And we're going to learn from this pilot,
20 and then we're going to scale. And so this is
21 where I would love to speak with many of you in the
22 room and talk to you about thoughts and strategies

1 there.

2 What do we mean by scale? We're
3 talking about in the next year or two thousands of
4 vehicles. And that might not seem like a ton, but
5 let me just put it in perspective. When you consider
6 that the entire EV fleet in the country is on the
7 order of hundreds of thousands of light-duty
8 vehicles, and we're talking about thousands of EVs,
9 and each one of our EVs displaces ten X the miles.
10 What I mean by that is our vehicles go 50, 75,000
11 miles a year as opposed to a personal vehicle. We
12 could be potentially be double digit percentages of
13 the EVMT, electric vehicles miles traveled in the
14 next couple of years. From Lyft, just Lyft alone.

15 So that is humongous business for
16 everyone. It's humongous environmental savings. And
17 what we're thinking about with that scale piece in
18 the middle there is where are we going to put
19 thousands of vehicles, and we don't know yet. We
20 want to talk to states. We want to talk to cities.
21 We want to get together coalitions from these
22 different areas to find the right place.

1 If we put 5,000 vehicles in Chicago
2 because it makes the most economic sense, we'll put
3 5,000 vehicles in Chicago. It's basically how can we
4 put together the best package of things so that we
5 can break even. That's our goal next year. We're
6 going to lose money on the pilot, because even with
7 an incentive, a Chevy Bolt is \$37,000, and a Hyundai
8 Sonata is \$6,000 when we get them on the used market.

9 We're going to lose money on the
10 pilot, but our goal next year is to break even. So
11 we need help from folks in the room to help us scale
12 and break even.

13 And then the really exciting part,
14 and the reason I joined Lyft, is this longer-term
15 mass deployment. We're talking about tens of
16 thousands of electric vehicles deployed across the
17 country that not only displace our gas vehicles, but
18 they provide clean transportation to our drivers, and
19 they allow folks to access clean mobility as a low
20 income driver potentially and also as a passenger.
21 So it's also the world's largest ride and drive.

22 You can imagine -- we just did our

1 billionth trip, which is really exciting, today. So
2 imagine a billion trips, imagine hundreds of millions
3 of trips in electric vehicles. That's exposing half
4 the country to an electric vehicle where right now
5 half the country doesn't know they exist.

6 So really excited about that. We
7 need help to do it, though. We have significant
8 barriers in terms of capital costs, in terms of
9 ownership models. I won't get in the weeds there,
10 but we are constrained in Chicago by some ownership
11 models. We cannot have an ownership stake in
12 vehicles. So even if we wanted to buy EVs in
13 Chicago, we legally can't. We'd love to talk to
14 folks about how we can potentially work on that.

15 And then we're also constrained by
16 charging infrastructure. It's great to have charging
17 infrastructure in the room. So we're looking at how
18 can we fuel that.

19 Because that's where we want to be.
20 We want to be where we make money in operational
21 savings with EVs, we're only constrained by fueling
22 infrastructure, and then we partner to build up the

1 fueling infrastructure, and we basically destroy the
2 chicken and the egg problem. Because we can do the
3 chicken or the egg, whatever you want to call it.

4 So that's all I've got. So we need
5 electric vehicle help incentives.

6 And I just wanted to briefly touch
7 on, we're big proponents of congestion pricing. I
8 showed the chart. We're less than 1 percent of the
9 MT. If you think you're going to solve the problem
10 by taxing us, you're not. We need to charge all
11 vehicles fairly for how they use the road, including
12 ours. We're fine with that. And then let's dedicate
13 some curb space to non-single-occupant vehicle use.

14 So that's all I've got. Thank you.

15 MS. HEATHER FLANAGAN: Hi, everyone. Thank
16 you for inviting ABB.

17 The mic is on. Maybe because I'm a
18 shorty here. Better? I can just yell. Two mic's.
19 I'll take two.

20 My name is Heather Flanagan. I'm the
21 Marketing Manager for ABB's EV infrastructure
22 business. I'm located up in Milwaukee, so I'm your

1 friendly neighbor cheese head to the north. Glad
2 that the Bears won last night so you're not going to
3 be taking it out on me.

4 (Laughter.)

5 MS. HEATHER FLANAGAN: I'm here to talk
6 about charging infrastructure and talk about what we
7 do at ABB, and then also talk about some of the
8 things that we think are important to infrastructure
9 of the future.

10 So I already introduced myself, and
11 mentioned what I'm going to talk about, so I'm going
12 to jump in and do a brief primer on charging. Not
13 everybody is 100 percent up to speed on the different
14 kinds of charging. David talked about it a little
15 bit earlier.

16 But charging infrastructure can take
17 the form of a simple, plug-in-the-wall, 120-volt
18 socket in your home, and it can go all the way up to
19 very high power charging. We're doing up to 600 KW
20 charging, for example, for buses in Europe, and
21 that's growing over here.

22 So it can really take a lot of

1 different forms. No single charging technology is
2 the right charging technology. Again, David alluded
3 to that. We need AC charging where vehicles are
4 sitting for hours. We need DC charging where
5 vehicles -- where their mobility paradigm is got to
6 have it now and go.

7 So it does cover this wide spectrum,
8 and really, the important thing is that it fits the
9 use case and fits the need. So that just sort of
10 covers the basics of when you're talking about AC
11 versus DC in terms of power level and scale.

12 So ABB, we're a pretty large company.
13 So we're 147,000 employees globally, and 25,000 of
14 those folks are here in the U.S. So sometimes we say
15 we're like the largest company you've never heard of,
16 because we're very focused on B-to-B type of
17 business. We work with utilities and industrial
18 automation. We do stuff that's really behind the
19 fence and in a factory.

20 But when it comes to EV
21 infrastructure, this is kind of an area where you
22 will see our logo on some equipment in the public

1 sphere. You're going to see a lot more, because we
2 have a lot of charging stations out there already.

3 We do 35 billion in revenue globally.
4 We're in a hundred different countries. And we've
5 been around a long time. A lot of people in the EV
6 world are startups, but ABB has been around 135 years
7 in electrification. So this is really what we do.
8 Technology is what we do. High power, power
9 conversion, and connecting equipment to the grid is
10 what we do and have been doing for a long time.

11 Specifically within our EV
12 infrastructure business, what we do and what we
13 focused on over the last several years has been DC
14 fast charging, high power charging. We have 8,000 DC
15 fast chargers now deployed around the world.

16 What's really important to what we do
17 and the future of what we do is standards, industry
18 standards, so that what the car connects to the
19 charger works with as many vehicles as possible, but
20 also, you know, the network and the software layers
21 that David talked about earlier, that that's also a
22 very important place for interoperability.

1 And I'll go a little bit into
2 standards and the importance in terms of scale.

3 We're all over the world, like I
4 mentioned. We have EV chargers in 65 countries
5 already. And another really important part about
6 every system is that it's connected and it's
7 intelligent and it can do really smart things.
8 Because a dumb charger sitting off in a parking lot
9 somewhere that no one can connect to and no one can
10 take care of is a way to kill the EV infrastructure
11 and EV business at large. So it needs to be
12 connected and online and delivering value for drivers
13 and owners alike.

14 All of our systems are made by ABB
15 with our technology, our operational excellence, and
16 our service is 24/7, 365. It has to be. Our drivers
17 aren't going to buy into owning an EV, and neither
18 are companies going to be investing in fleets if the
19 charging infrastructure isn't up 24/7, 365.

20 So some of the work that we've
21 already done over the last several years, one of the
22 biggest projects more recently that we've been

1 working on, we're working on right now, is the
2 Electrify America Project.

3 Many of you, I'm sure, are familiar
4 with Electrify America. They're the subsidiary
5 created by Volkswagon post-diesel-gate scandal. So
6 they're deploying 10 billion dollars --
7 2 billion dollars over the next ten years in EV
8 charging infrastructure. We were happy to be awarded
9 a nice piece of that project, the first phase of that
10 project, and we are underway. We've deployed the
11 first 350 KW chargers in the western hemisphere,
12 possibly in the world that are public-facing, 350-KW
13 charging stations, and that is rolling out very
14 quickly over the next several months.

15 We've also partnered with EVgo. EVgo
16 has charging stations here in the Chicagoland area,
17 and we have a few of those systems. One specifically
18 I can think of I visited at Woodfield Mall in
19 Schaumburg.

20 We've done a number of other projects
21 around the world, major, large scale, hundreds of DC
22 fast chargers in countries around the world. So

1 that's really been where we've learned is in the
2 commercial public space.

3 But we've also been doing a lot in
4 the bus and truck charging space. Many projects
5 happening around the world up on the screen. I won't
6 go through them all, but a lot in Europe. Some with
7 overhead pantograph charging, some with depot
8 overnight charging. Much more happening now here in
9 the U.S. and up in Canada.

10 And underpinning a lot of that work
11 is that we have very close collaborations with the
12 automakers. Again, if the cars and the chargers
13 don't work together, if the development is not done
14 early and the standards work isn't done
15 collaboratively, you're going to have a lot of
16 fragmented -- a fragmented market that can't grow as
17 quickly, because the handshake has to happen between
18 the car and the charger for confidence to grow in EV
19 infrastructure.

20 So I'm glad that Jon brought up
21 scale, because it's definitely a huge, important
22 issue when it comes to the proliferation of charging

1 infrastructure. Everyone kind of knows that charging
2 infrastructure is a major bottleneck to the
3 proliferation of electric vehicles. So scale is just
4 a critical issue.

5 And certainly, open standards are --
6 they're a very important thing that we do a lot of
7 work in. Because standards deliver so much. They
8 deliver safety to the industry. They deliver
9 certainty for the market to grow, things like supply
10 chain.

11 We can bring costs down when everyone
12 is working on the same page, delivering the same
13 charging connection to the vehicle, and that the
14 software layer, that everyone is working in the same
15 space, so that the industry at large can grow and
16 interoperability can support that. So that's really
17 important to scale.

18 Also, connectivity. I mentioned our
19 chargers are all connected. Every time a new EV
20 comes out, sometimes there might be some little
21 nuance in the software of that EV from the battery
22 management system that the charging stations have to

1 accommodate for. We can push out one software update
2 through thousands of chargers, and it's immediately
3 taken care of. Imagine having to send a field
4 service engineer to every single station to do an
5 update. It's not feasible.

6 So being connected, being able to
7 integrate intelligent APIs so that the utilities can
8 do power management. David talked about the
9 importance of that. That's really important. And
10 connectivity gives you that.

11 In addition, all the different
12 business models that need to play out, being able to
13 do different marketing programs, being able to do
14 different kinds of payment plans, drive data, use
15 that data in an intelligent way. Connectivity
16 just underpins all of that capability from a charging
17 station.

18 What's really important is scale
19 through partnerships and planning. So really
20 important that charging projects that are funded --
21 we see a lot coming now down the pipeline of funded
22 projects all over this country -- that there's not

1 just a focus on, well, let's budget money for buying
2 the equipment and throwing it in the ground, and then
3 everything else is going to take care of itself.
4 Because if there's no operational model in that,
5 we're going to have a lot of stranded chargers out
6 there.

7 There has to be accountability from
8 the ownership, the operator, the site host, the
9 hardware manufacturer, like ABB, and even the
10 automakers have a play in that along with the
11 utilities. So those folks all working together make
12 for a much healthier charging infrastructure versus a
13 fragmented approach.

14 Lastly, I wanted to mention the
15 utility role. Utilities are extremely important.
16 They're experts at scaling high power infrastructure.
17 When we're considering scenarios when we have very
18 high power demand and very small, concentrated
19 sections of an urban area, or if we've got to deliver
20 very high power on a highway corridor in the middle
21 of nowhere for drivers or truck drivers, that's going
22 to require significant involvement from the

1 utilities.

2 So they really need to be engaged.
3 They need to be allowed to do work with rate design.
4 They need to be able to engage different models on
5 demand charges, so that the business models can
6 flourish in higher power charging applications.

7 And again, I mentioned projects
8 really need to have an operational health and
9 lifetime cost aspect to their funding and deployment;
10 otherwise, charging infrastructure can't serve the
11 needs of its intended users.

12 That's it.

13 MS. TANYA GUTIERREZ: Great. Thank you.

14 On behalf of the Commission, I would
15 like to thank the presenters for educating us on the
16 future of delivery and service fleets and the
17 accompanying infrastructure.

18 We will now move into the Q and A
19 portion of the panel. I will pose a question to the
20 entire panel, and anyone can feel free to respond.

21 So, Austin, you mentioned incentives
22 in the state of California. So when we're talking

1 about electrifying commercial service and delivery
2 fleets, how important is government support and
3 incentives, and does consumer demand outweigh the
4 lack of government incentives?

5 And like I said, anyone can feel free
6 to answer.

7 MR. AUSTIN HAUSMANN: I'll touch briefly on
8 it before turning it over to somebody that's maybe
9 more versed in policy.

10 I would say it's absolutely
11 paramount, and I think what we're finally starting to
12 see is the point where -- I think we had a few TCO
13 slides across the panel that represented that where
14 EVs make commercial, viable sense today, and we've
15 finally reached that tipping point.

16 I believe Kevin would mimic this, but
17 getting into the automotive industry isn't casual,
18 and we haven't seen probably the momentum or the
19 input from the large OEMs that we would like to see,
20 particularly early. And most of the solutions that
21 exist today are startup environment or smaller
22 companies, such as Kevin's and ours.

1 So I think having that governmental
2 support to back the R&D and engineering effort that's
3 required to bring EVs to market is paramount, and now
4 that we've seen the tipping on the economics, we're
5 seeing a larger tip on the demand side as
6 well.

7 MR. KEVIN VINCENT: What he said, but to
8 expand upon that, the traditional truck OEMs have all
9 announced they're going to get into the electric
10 business, and that's probably true -- four, five
11 years from now that probably is going to be true.
12 But they have a huge amount of investment in diesel
13 engines, and all the complexities of operating
14 internal combustion engines, and they don't want to
15 strand all those assets. So they're not pushing this
16 to happen.

17 They're being pushed by the Chinese
18 government. They're being pushed by the multitudes
19 of European governments that are demanding the
20 elimination of diesel. But probably, the U.S.,
21 because the national policy right now is to do just
22 the opposite of demanding the change, it's only

1 occurring in certain areas like, particularly,
2 California. It's going to lag in the U.S. without
3 governmental push or governmental pull.

4 And the voucher programs, the
5 California HVIP voucher program being far and away
6 the best example, is the huge pull.

7 And right now, I mean, we're based in
8 Ohio with a factory in Indiana, and you'd think we'd
9 be planning on selling trucks in Chicago and in the
10 midwest, but in fact, all of our production right now
11 is going to be going to California. And why? It's
12 because the HVIP program is so generous, it makes it
13 a no-brainer acquisition for the fleets in California
14 to be taking advantage of those very generous HVIP
15 vouchers.

16 And Chicago was forward thinking. It
17 actually had a voucher program with the Drive Clean
18 Trucks Program, but it hasn't been funded for the
19 last year. It would be good if some other
20 jurisdictions, the State of Illinois, maybe the city,
21 itself, could re-fund this program, the existing
22 program.

1 But those sort of voucher programs
2 are necessary to provide the financing that us little
3 guys need to change the game, to disrupt the market,
4 because, otherwise, the market is going to do this
5 when it's forced to four or five years from now, and
6 Workhorse and Chanje and the two or three other
7 companies involved in this, we want to do it as soon
8 as we have enough money to do it.

9 MR. JON WALKER: I'll just add a little bit
10 to that. Similarly, we could wait for T and Cs to
11 electrify until battery cost falls and there's a
12 robust used car market and low income drivers can
13 afford to buy a used long-range vehicle. But that
14 could be five, ten years. With the way things are
15 going federally, that could be never. The momentum
16 could stop.

17 So we absolutely need state and city
18 incentives for us to go now. So what we're going to
19 be looking for is what city and state can put
20 together incentives so that we don't lose \$10,000 a
21 vehicle, because we can't scale that way.

22 How are we going to put together a

1 package where we put skin in the game, the city and
2 state puts skin on the game, maybe a charging partner
3 puts skin in the game, and we go in on this together,
4 and we go big. So that we absolutely need help from
5 all sides.

6 MS. HEATHER FLANAGAN: I guess I would only
7 mention that from the charging infrastructure
8 standpoint and definitely from the vehicle side, I
9 think it's clear that government incentives, rebates,
10 and those type of programs are great and have helped
11 quite a bit.

12 From the infrastructure side, it's
13 really about -- and I mentioned it in my comments --
14 the holistic approach, funded programs of a holistic
15 approach that are really looking at infrastructure
16 that serves users and that has partners that are
17 committed to the lifetime of the infrastructure is
18 going to be money well-spent. And we've seen old
19 programs from years gone by where money was thrown at
20 charging infrastructure without a plan to operate and
21 manage back in the early days, that there were a lot
22 of operational issues with those.

1 So definitely want to see investment,
2 but want it to be well-spent and well-planned.

3 MR. DAVID PETERSON: Perhaps just to
4 underscore that last point on why infrastructure
5 funding is important, it has everything to do with
6 fleets typically not having any budget allocated for
7 this new infrastructure as you transition to a
8 completely new fueling paradigm.

9 Today, fleets have on-site fuel, so
10 they have invested usually in some tanks and some
11 nozzles. Sometimes they fuel off-site at existing
12 gas stations or other fuels -- non-return-to-base
13 facilities. Most of these fleets are not going to
14 be en route -- most of these fleets are not going to
15 use en-route fueling. I think that's the big
16 paradigm shift. The vehicles are most likely to fuel
17 where they park.

18 And so you're asking now
19 infrastructure to be invested in parking spaces.
20 That's the big shift, and that's why you need
21 additional capital to be matched with the vehicle
22 capital to really move the market forward.

1 MS. TANYA GUTIERREZ: Thank you.

2 So furthering our discussion on
3 infrastructure, what kinds of changes do you believe
4 need to be made to the current infrastructure to
5 accommodate for the optimal amount of charging
6 stations?

7 MR. DAVID PETERSON: Can you define the
8 current infrastructure?

9 (Laughter.)

10 MS. TANYA GUTIERREZ: Or lack thereof, I
11 guess.

12 MR. DAVID PETERSON: I'll just take the
13 continuation of the last comment that I had,
14 which was the shift -- it's the paradigm shift in
15 fueling.

16 So today, fleets either -- it's a
17 through-put model for the majority of fleets; right?
18 Either go to a fueling station, spend a few minutes,
19 and then they're off either continuing their job, or
20 they're back parked where they normally park their
21 vehicle.

22 Or they return to base, and, again,

1 it's a through-put model. They fuel. No matter what
2 the vehicle is; right? It could be a bus. It could
3 be a forklift, whatever it is. Well, forklifts, a
4 lot of them are electrified or they run on different
5 fuels. But the majority of vehicles aren't using a
6 through-put model.

7 So now we're shifting to a
8 predominantly parking-based model for fueling, and so
9 the infrastructure that needs to be there actually is
10 the dispensers, the dispensation working from the
11 point of the vehicle backwards; right? So you've got
12 to have dispensers for those vehicle. The ratio can
13 vary depending on the fleet operations, and then you
14 work backwards from there. So you need, obviously,
15 from -- on the customer's side, you need to have that
16 infrastructure, so that's trenching, that's panels,
17 that's all the conduit necessary.

18 That's a lot of additional capital
19 that a fleet would have to invest in on the property.
20 And there was a point mentioned earlier about the
21 different types of property ownership, et cetera. So
22 who makes the investment is often a negotiated thing

1 with the different parties involved depending on how
2 the property is managed.

3 Then you can move upstream now of the
4 actual property, and now you're working with the
5 utility, a retail utility, a distribution utility,
6 and that's where oftentimes as you get to larger
7 and larger projects -- and these projects can get
8 quite large very quickly. The transit industry knows
9 this.

10 You just get a handful of buses, and
11 all of a sudden you're asking for a brand new service
12 for megawatts of power from a utility and how quickly
13 you can get that and how much that costs. Where you
14 site that new infrastructure, transformers and such
15 become the next consideration.

16 So that's why it's important at the
17 outset of a project to really understand where a
18 customer is going over the next three, five years,
19 have visibility really to where they want to be.
20 Because these are large capital investments that you
21 don't want to be repeating every six months, every 12
22 months; right? Or whatever the vehicle replacement

1 cycle is or adoption cycle.

2 You just want to make one investment,
3 or you really just want to minimize the number of
4 large capital investments you have to make. So
5 three-to-five years is the typical time horizon that
6 we look at. So plan ahead for the capacity that
7 you're going to need.

8 Now, that takes a lot of thought and
9 planning, which is critical, which is why we, as
10 folks in the charging industry, need to work very
11 closely with the OEMs and the vehicle manufacturers
12 and the customers to understand what products are
13 going to be available and in what volumes fleets plan
14 on adopting them.

15 MR. KEVIN VINCENT: If I can add a couple
16 of things. We know with each of our fleets that we
17 talked to that part of the equation is always, you
18 know, what are the hoops they have to run through
19 from your credit standpoint as well as what is the
20 cost standpoint to bring the infrastructure needed,
21 which is going to be a bank of chargers at their
22 fleet location.

1 And it's a good idea to make sure
2 that the governmental bodies understand the benefits
3 to the society, to the jurisdiction of easing that
4 process. You want to make sure that the -- to take
5 the macro issue that the -- for the utilities, the
6 massive investment utilities are going to need maybe
7 to bring enough electricity to all the different
8 sites. There's some good policy benefits in not
9 using the normal rate structure issue that public
10 utility commissions will apply to that.

11 So factoring in that decisionmaking,
12 the value of what the utilities are achieving by
13 enabling electrification is really important.

14 And then in the micro level when you
15 have just some of the permitting problems when you're
16 doing just any sort of construction, you want to make
17 sure you ease as much as possible, how long it's
18 going to take to put in that bank of chargers, and
19 whatever additional conduit coming on site and
20 additional electricity on site.

21 You don't want to have a six-month
22 delay while you're waiting on permits to something

1 that can take be taking, you know, NOx emissions and
2 taking particulate matter and helping combat climate
3 change. There's an end goal here which is going to
4 benefit society and benefit the local jurisdictions
5 by making it as easy as possible for this transition.

6 MS. TANYA GUTIERREZ: Does anyone in the
7 audience or any of the Commissioners have a question?

8 Commissioner Rosales?

9 COMMISSIONER ROSALES: Kevin, I found that
10 fascinating on the drone. And I just have a question
11 on the end-use customer.

12 First of all, thank you for
13 explaining about the logistics of UPS and how they
14 rarely logistically like to build their routes by
15 turning left. I explained that to my policy
16 advisors, and they thought I was nuts. So thank you
17 for saying that.

18 But the drone, how does it get to the
19 end-use customer? I understand that in suburbia, it
20 would be much easier, but in a place like this, if we
21 needed a package delivered, do you drop it on the
22 roof? How does it get to someplace if we needed it

1 here today?

2 MR. KEVIN VINCENT: So the technical answer
3 and the legal answer are dramatically different
4 there. Technically, sure, you can program the drone
5 to drop it on a roof or at somebody's doorstep.

6 But do you want to allow drones to
7 operate everywhere? We want to sell drones, so our
8 business answer would be yes. But practically
9 speaking, there will always be limits on where drones
10 can operate.

11 Luckily, when you're programming an
12 autonomous drone, you can geopath them essentially
13 and say there's certain areas you can't operate. The
14 FAA is not going to allow you to fly everywhere to
15 begin with, but then local jurisdictions are going to
16 be deciding, or it could be state level -- it
17 probably won't be federal level, but who knows -- how
18 the drones can actually operate.

19 So, you know, we're a long way from
20 full-scale deployment of this, but those decisions
21 will have to be made as a matter of policy is where
22 do you want the drones flying. You can program them

1 to fly safely. You can make sure they don't drop on
2 people's heads. That is something that can be done.
3 But clearly, you don't want that actually happening
4 or anybody getting hurt by drone operation.

5 MR. AUSTIN HAUSMANN: I think there's
6 something to be said there, too, about the modality
7 of what the drone is solving, and it's supporting a
8 larger, ground-based vehicle. So whether it's drone
9 or ground-based, robotic vehicles, you could even
10 have couriers on bicycles that help support the
11 ad hoc nature.

12 I think there's an ecosystem to be
13 had there to have the most efficient delivery
14 possible, and there won't be one solution that solves
15 it all.

16 MS. TANYA GUTIERREZ: I have a final
17 question for the panel.

18 How soon will EV trucks be able to
19 travel across state lines and travel long ranges as
20 easily as internal combustion engine trucks?

21 MR. KEVIN VINCENT: The state lines, you
22 know, range can be the problem and where can you

1 change. State lines really won't be a problem at
2 all. Commerce is different, but EVs, that's just not
3 going to be an impediment.

4 MR. AUSTIN HAUSMANN: I think it's
5 important to know that in the last mile space, I
6 think it's roughly 80 percent of all vehicles travel
7 less than 100 miles a day. So against mass adoption,
8 the technology exists today to support that. There's
9 obviously going to be edge cases that aren't
10 well-suited for today's technology.

11 But I think there's an interesting
12 paradigm to look at, and the mileage offset is our
13 friend. So if we have the technology to support 500
14 and 600 miles a day, the fuel economy savings are
15 tremendous at that point. So it's more of an
16 economic case.

17 I think the technology exists that
18 you can certainly package thousand mile vehicles with
19 today's technology. It's just more of a commercial
20 viability and a mass adoption perspective at this
21 point.

22 MR. DAVID PETERSON: I'd say we can do it

1 today. It just depends on how close you are to the
2 state line.

3 (Laughter.)

4 MS. TANYA GUTIERREZ: Well, that's all the
5 time we have for today, but thank you again for
6 everyone's participation.

7 And please help me in giving our
8 panelists a round of applause.

9 (Applause.)

10 MS. TANYA GUTIERREZ: We'll take a short,
11 five-minute break and reconvene then.

12 (WHEREUPON, a five-minute recess
13 was had.)

14 ACTING COMMISSIONER PALIVOS: Welcome back.
15 Our next panelists will discuss electrification of
16 public transportation and the necessary
17 infrastructure to create real value for cities and
18 consumers.

19 To lead our discussion, I would like
20 to introduce Emily Brumit, one of my legal policy
21 advisors. Please join me in welcoming Emily.

22 (Applause.)

1 MS. EMILY BRUMIT: Thank you, Commissioner
2 Palivos.

3 My name is Emily Brumit, and I'm the
4 moderator for Panel II. The purpose of this panel is
5 to discuss the value in electrifying public
6 transportation. We'll hear from our panelists with
7 direct experience in this endeavor and learn about
8 the challenges and opportunities associated with
9 electrifying city buses.

10 The format of the panel will consist
11 of brief presentations by each of our panelists
12 followed by a series of questions. If time remains
13 at the end, we'll take questions from the audience.

14 First we'll hear from Roland Cordero,
15 Director of Maintenance and Vehicle Technology at
16 Foothill Transit.

17 Next we'll hear from Kent Leacock,
18 Senior Director of Government Relations and Public
19 Policy at Proterra.

20 Following Kent, we'll hear from Kate
21 Tomford, Senior Analyst at the Chicago Transit
22 Authority.

1 And then Lisa Jerram, Director of
2 Bus, Paratransit, and Surface Transit, at American
3 Public Transportation Association.

4 And last, but certainly not least,
5 we'll hear from Andrew Barbeau, President at the
6 Accelerate Group.

7 Please join me in welcoming our
8 panelists.

9 (Applause.)

10 MS. EMILY BRUMIT: Roland, you are free to
11 begin.

12 MR. ROLAND CORDERO: Oh, where did you get
13 that picture of me?

14 Thank you. Again, my name is Roland
15 Cordero. I'm the Director of Maintenance and Vehicle
16 Technology at Foothill Transit. Foothill Transit is
17 located in L.A. County. We're 40 miles east of
18 downtown L.A. We operate about -- we have
19 14 million -- sorry about that.

20 MS. EMILY BRUMIT: Would you mind getting
21 Paul? Let's see.

22 (Brief pause.)

1 MR. ROLAND CORDERO: There you are.

2 Foothill Transit is a joint powers
3 authority. We operate transit service in 22 cities
4 in the San Gabriel Valley area, which is 40 miles
5 east of Los Angeles. We provide service to downtown
6 L.A. for our commuters.

7 We cover a 327-square-mile service
8 area with over 14 million riders a year, and we have
9 36 local and express routes.

10 We actually have a total fleet size
11 of 373 buses. This is an older number that we have
12 on the slide. We have 343 CNG buses and 30 electric
13 buses.

14 And the reason why we started with
15 electric buses was part of our mission is to be
16 committed to innovation, and in addition, the
17 California Air Resources Board is coming up with a
18 regulation requiring transit agencies to shift over
19 to zero emissions feed by 2040.

20 MS. EMILY BRUMIT: It seems as though the
21 PowerPoint is on auto, so it's switching slides
22 automatically. Apologies.

1 And thank you, Paul.

2 (Brief interruption.)

3 MS. EMILY BRUMIT: Thank you all for your
4 patience.

5 You all still get your same allotted
6 time. Do not worry.

7 (Laughter.)

8 THE AV TECHNICIAN: I'll move it manually.
9 Were we on this slide?

10 MR. ROLAND CORDERO: No, I need you to go
11 back. There you go.

12 So we started in 2010 with three
13 Proterra fast-charge electric buses. These buses
14 have a range of 35 miles. In 2014, we added 12 more
15 of the fast-charge buses, which enabled us to
16 electrify one of our bus routes, Line 291, and I'll
17 describe that later.

18 Then in 2016, we added two 40-foot
19 Proterra Catalyst buses. These are 40 foot, but they
20 also have a range of only 35 miles.

21 And then last year in December, we
22 added 14 Proterra Catalyst E2 40-foot buses, which

1 have a range of 250 miles.

2 Next slide, please.

3 The current service, when we bought
4 our first buses, we electrified Line 291, which is a
5 16.1 mile route from the city of Pomona up to the
6 city of Laverne. It's almost like a circulated
7 route. It's a short route. It only has a range --
8 the route is 16.1 miles long round trip. Again, the
9 bus has a 35-mile range. So we charge the buses at a
10 Pomona Transit Center, which allows us to charge it
11 back from 60 percent to almost 100 percent in about
12 seven minutes while passengers board.

13 And we have about eight buses that we
14 operate on this line during peak hours. Again, it's
15 fully electrified since we added 12 buses back in
16 2014.

17 Next slide, please.

18 Last year, we acquired 14 Proterra
19 Catalyst E2 extended-range buses. We will operate
20 these buses on Line 280, which runs from the city of
21 Azusa to the city of Vernon Hills. The route is 22
22 miles long, and our intent is to operate the bus --

1 charge them at the yard and operate them in service
2 all day long with some opportunity charging at the
3 Azusa Intermodal Transit Center.

4 Next slide, please.

5 So we have two charging stations --
6 actually, two charging stations at the Pomona Transit
7 Center. We have two chargers located at that center
8 to allow us to charge buses that are northbound and
9 southbound.

10 One of the reasons why we installed
11 two charging stations is to allow us an opportunity
12 to charge the bus if one charging station is out of
13 service.

14 Next, please.

15 There you have the charging station
16 we built last year at the Azusa Intermodal Transit
17 Center, AITC. It is a fast-charge station, which
18 will allow us to provide opportunity charging on
19 those 14 buses that we acquired last year. And it's
20 installed next to the Gold Line tracks, which
21 provides a light rail service from the city of Azusa
22 to downtown L.A.

1 So the buses that we acquired last
2 December, these are extended-range buses that have a
3 nominal range of about 251 miles.

4 We tested the bus on three different
5 routes. We tested it on Line 280, which is a local
6 route, and instead of getting 250 miles, we only were
7 able to reach about between 149-to-169 miles. So
8 actual service of a bus would really change the range
9 of the bus depending on the route, itself.

10 We also tested the bus on an express
11 route, which is a 45-mile route to downtown L.A. and
12 back, and we were able to get a range of 194 miles.
13 The reason being is that express route is a
14 limited-stop route. It only has four stops. And
15 when you're on the freeway, once you have the bus
16 moving, with the momentum, you don't really need that
17 much power to keep the bus rolling.

18 We tested the bus again on the same
19 line, Line 280, where we acquired a 159-mile range
20 with opportunity charging. We were charging the bus
21 every two hours with a five-minute trickle charge,
22 and we were able to acquire a range of about 250

1 miles on that bus.

2 So providing opportunity charging at
3 the route extends the range of the bus. This is from
4 100 percent to 10 percent stated charge. You
5 normally don't want to deplete the stated charge to
6 10 percent, because you're going to deplete the life
7 of the battery.

8 Current challenges, we heard earlier
9 about infrastructure. Installing in-depot charges is
10 a big issue. We have space constraints. We have a
11 fleet of 373 buses in both -- the fleet is
12 practically split between the two yards. And when
13 the bus -- when the yards were designed, they were
14 designed for bus parking without any anticipation of
15 pedestals-mounted charges.

16 So we're facing space constraints in
17 terms of infrastructure and installing in-depot
18 chargers.

19 Next slide, please.

20 So our design point in terms of
21 in-depot charging is utilizing an overhead charging
22 system so that it will eliminate the installation of

1 pedestal mounted charges in the yard. When you're
2 installing one charger for each bus, you're
3 practically talking of a half a bus parking space off
4 the yard.

5 And we still have to do a study. Do
6 we really need one charger per bus? Because there
7 are times that you would have buses that are coming
8 back into the yard after their peak hours, and we're
9 given the opportunity to charge those buses. So we
10 still need to do that study and look at our service
11 layout and see when the buses return back to the
12 yard.

13 Next slide, please.

14 Operating electric buses. They're
15 not an easy task. They're a very complex project. I
16 think you have heard the adage that the easiest part
17 of fleet electrification is acquiring a bus. You
18 issue an IFB for buses and you'll have bus OEMs that
19 would sell you the bus.

20 The hardest part is the
21 infrastructure, how to charge them. Charging a fleet
22 of 20 buses is easy, but when you're rolling over a

1 200 percent fleet like we have an initiative to go
2 100 percent electric by 2030 with 373 buses, when do
3 you roll out the infrastructure? You obviously can't
4 take out -- your buses out of your yard and build
5 your infrastructure at one time, so you need to do it
6 on a scheduled process.

7 In addition to that, when we buy
8 buses, we buy buses on a schedule. We're looking at
9 30 buses per year. That's the easiest part of bus
10 procurement is rolling in small portions of buses.

11 I can't see my slide. I'm sorry.
12 Next slide, please.

13 Energy management. Utility rates, we
14 probably have one of the highest rates in electricity
15 in Southern California. We pay 18 cents per kilowatt
16 hours, which is not tantamount to what we're paying
17 for CNG. In terms of per mile cost, it costs about
18 48 cents per mile in electricity and about 36 cents
19 per mile on CNG. So utility is a big issue. Utility
20 price is a big issue.

21 Demand charges can also cost up to 25
22 percent of your utility bill. So the way that you

1 can eliminate that is to -- or mitigate that is to
2 deploy more buses on specific routes.

3 Next slide, please.

4 Lessons learned. So en-route
5 charging is a very -- en-route charging is not --
6 it's an inflexible way of charging buses, because you
7 don't want to put en-route charges with every route
8 that you operate. So what we're looking at is
9 purchasing buses that have extended range.

10 A CNG bus or an internal combustion
11 engine bus has a range of 350 miles. So if you're
12 going to switch over to a 100 percent fleet, you need
13 to have a one-to-one replacement, because if
14 you're -- with today's technology, the ones that we
15 have only have a range of 250, and that range changes
16 depending on the route. As I mentioned earlier, we
17 can go from 149 to 250 depending on the route that
18 you're servicing the bus.

19 So the only way that you can shift
20 over to 100 percent fleet electrification at this
21 time is adding more buses to your route, which means
22 that you would have to add more drivers to provide

1 that service.

2 Next slide, please.

3 Issues with clean electrification,
4 also, is what kind of backup power do you need in
5 case electricity goes out. Solar panels don't have
6 enough energy to charge a fleet of buses, so we're
7 looking at stationary fuel cells to help us create
8 our own electricity using compressed natural gas or
9 natural gas.

10 Next slide, please.

11 Benefits of stationary fuel cells.
12 They're really more stable than electricity. They're
13 consistent and they can provide you continuous power.
14 You can run your fuel cell station 24 hours seven
15 days a week and create your own electricity to charge
16 the electric bus and provide electricity to your
17 facility.

18 Next slide, please.

19 Our next project, we're looking at
20 electric double deck buses, and by next year,
21 November of 2019, we're working with Alexander
22 Dennis. The reason why we're looking at electric

1 buses is to provide you a higher capacity to move
2 passengers. We're looking at a range of about 150
3 miles on these buses. We plan to operate them on our
4 express routes in downtown L.A.

5 Next slide. That's about it. Thank
6 you.

7 MS. EMILY BRUMIT: Thank you, Roland.

8 MR. KENT LEACOCK: Good afternoon,
9 Commissioners and members of the audience. My name
10 is Kent Leacock.

11 Next slide.

12 This is just a brief look at our
13 management company. I don't know how many of you
14 know about Proterra. We are the leading electric bus
15 manufacturer in the U.S. We got started a number of
16 years ago.

17 Next slide.

18 We are beyond the startup phase, and
19 we currently have three manufacturing facilities in
20 Burlingame, California, where we manufacture our
21 battery packs for our own buses and for other
22 applications.

1 Our Southern California manufacturing
2 facility is in the city of Industry. Coincidentally,
3 it's right around the corner from Roland's operation
4 near Foothill. And our original factory in South
5 Carolina that serves our eastern half of the U.S.
6 customers.

7 Proterra. As Roland mentioned, the
8 first buses that he bought were fast-charge buses,
9 and that's all that we made. They were opportunity
10 charged for all of our customers, and when I joined
11 the company, we had six customers in early 2015. By
12 the end of the year, we had about approximately 12,
13 but we learned quickly that our customers, transit
14 agencies across the U.S., wanted buses that could run
15 the full route and have the same sort of duty cycle
16 that they were getting out of their fossil fuel
17 buses, and that basically meant extended-range buses
18 that could run the route for the day, charge at
19 night, and then run the route for the day.

20 Fast forward to now. We are now in
21 over 41 states with over 90 customers, a number in
22 Canada as well, and if you look at Illinois, back in

1 the original slide, we had zero customers in
2 Illinois. Now we have four.

3 And those included Jones Lang LaSalle
4 Leasing Company, which was our first commercial
5 customer running buses that you may have seen here in
6 the city, for those of you that are residents, in the
7 crazy designs with octopuses and multi walled colors.
8 Those are all fast-charge buses similar to Roland's
9 buses.

10 We recently won an RFP with the
11 Chicago Transit Authority, and we're also in Moline,
12 Illinois, and I just can't read the fourth one up
13 there.

14 (Laughter.)

15 MR. KENT LEACOCK: So, however, this is a
16 trend that's taking hold. You can see there that
17 there's multiple cities across the U.S. that are
18 pledging to go 100 percent electric by a date
19 certain, and including Foothill Transit as well as
20 New York City, which is the largest transit agency in
21 the U.S. You have L.A. Metro, which is the second
22 largest transit agency in the U.S. You have Seattle,

1 which is about the fourth or fifth largest transit
2 agency in the U.S.

3 And one of the main reasons, as
4 someone on the other panel mentioned, is that as time
5 passes and depending on your cost of electricity, the
6 total cost of ownership is advantageous over fossil
7 fuels.

8 So this is a curve of the overall
9 market in terms of the growth of electric bus sales,
10 and as you can see, to this moment in time, the ramp
11 up has been dramatic, where the industry was
12 basically limping along from 2009 to about 2014,
13 2015, and now it's exploded to the point where the
14 percentage of electric buses sold as new bus sales
15 has exceeded the percentage of passenger-vehicle
16 electric vehicles sold as a percentage of overall
17 sales across the U.S., and, in fact, transit is
18 likely to surpass the passenger vehicle market and
19 get to 100 percent electric across the U.S. well
20 before at least -- or at least in the high 80s.

21 Now, this is just a representation of
22 two of our existing customers. One is right here in

1 Illinois, Moline, and the other is Park City, the
2 difference being that one is operating fast-charge
3 buses, and one is operating depot-charge buses. So
4 as you can see there, the orange representation is
5 the mileage run in a given date and the state of
6 charge of the buses. During the beginning of the
7 day -- and those are -- each bar is an incremental
8 half hour or so.

9 So as you can see, they have multiple
10 charge events on the fast-charge buses as they run
11 10, 15, 20 miles; whereas -- and those are the --
12 that's the state of charge staying up. When you see
13 the big dips, that may be because they did a route
14 without charging, skipped a charge, and then charged
15 on the next go around to get themselves back up to a
16 full state of charge.

17 The interesting thing is that you'll
18 see at roughly the -- once you get to the very top of
19 the scale, that's the mileage for the day, and you'll
20 see that state of charge is at the bottom, and it
21 gradually ramps up back to where it is at the very
22 beginning of the representation the first thing in

1 the morning.

2 And that's an indication of the
3 importance of fleet charging with a fleet of
4 overnight or depot charged buses, because we've
5 seen -- you know, as we mentioned, the fast charge
6 technology, most transit agencies didn't want to
7 embark on that. And after we launched these
8 extended range buses, those are 90 percent of our
9 sales now.

10 And that is an indication of how they
11 will charge and the regularity, because what they
12 will do is they will run their course during the day.
13 Their state of charge will slowly go down to the
14 evening time, and then in this particular instance in
15 Moline, the buses start charging again at around 9:00
16 or 10:00 p.m., and they charge throughout the course
17 of the evening, finish up, and then they start off
18 their day first thing in the morning there with their
19 low miles at a full state of charge. So that's a
20 regular and consistent charge.

21 Now, that's just showing the energy
22 storage on the bus. You can see conversely there,

1 the energy storage on the Moline depot charging
2 buses, which are the same buses that Chicago will be
3 getting, slowly goes down. It looks like they maybe
4 did some sort of opportunity charge midday briefly or
5 something. Maybe it was lunchtime, and they plugged
6 in to get a little trickle charge, as Roland
7 mentioned, with some of their longer routes.

8 But then the state of charge
9 gradually goes -- the energy storage gradually goes
10 down until the evening correspondingly, and then the
11 energy on the buses goes back up again overnight as
12 they're charged overnight.

13 Now, this is an example of the
14 savings just on the fuel side of things that a high
15 mileage transit agency can save in terms of the
16 cost.

17 Now, in Utah, they have relatively
18 inexpensive electricity, but this is a fleet of six
19 buses that at the end of a one-year period, on these
20 six buses alone, they have saved \$200,000 in fuel
21 costs with electricity as a fuel versus diesel as a
22 fuel. And you have saved yourself 122,000 gallons of

1 diesel and hundreds of thousands of pounds of
2 greenhouse gas emissions.

3 Because the other thing is that, as
4 you can see, all these different fuel sources have
5 various levels of emission. Even natural gas has a
6 high level of GHGs, and, of course, you're getting
7 zero with electric buses.

8 And as the mix of energy has changed
9 and they're becoming more and more renewable, the
10 buses become cleaner.

11 Now, the interesting thing is that
12 the double-decker bus that Roland mentioned as well
13 as other applications are going to become
14 electrified, and, in fact, the Proterra factory that
15 builds battery packs makes assorted packs of energy
16 size for different applications. The full 110 pack
17 is what goes in a bus. Four of them are generally on
18 the underside of the bus. So it can carry 440
19 kilowatts of energy storage. But those other medium
20 sized ones, the one in the middle size, that's going
21 to be a series of battery packs that are going into
22 that Alexander Dennis double-decker bus.

1 We're also looking at -- then the
2 other thing that was mentioned was energy storage.
3 Well, second life of batteries allows for energy
4 storage applications, and the reason that's important
5 is that once the buses are no longer good for
6 transit, they still have a lot of energy storage
7 left, and they are made in our factory to be able to
8 be stacked, and they can be used for demand charged
9 mitigation by transit agencies. They can be used as
10 emergency backup power.

11 We've had multiple companies
12 coming to us asking, can we use them as backup power
13 at cell towers, and that's of importance to the
14 transit agencies, because initially they were
15 concerned, well, what are we going to do with these
16 batteries when it's time to swap them out. Well,
17 there's a readymade market for these second-life
18 batteries.

19 These are just some of the other
20 applications that it's going to be important for
21 utilities and utility commissions to pay attention,
22 because any workhorse application that's

1 fossil-fueled powered can be converted to battery
2 electric. We're looking at electric locomotives,
3 school buses, backup power for infrastructure,
4 trucks, as was previously mentioned on the other
5 panel, and then, once again, as energy storage.

6 Proterra has embarked on our own
7 method of charging and our own hardware such that we
8 can have multiple solutions depending on the
9 customer's need up to 500 kilowatts, 60 and 120, and
10 remember, DC fast charging in the passenger vehicle
11 market is slow charging. So when Roland was talking
12 about slow depot charging, that's with a DC fast
13 charger, but it's a slow charge for a bus that holds
14 over 400 kilowatts of energy.

15 Once again, the scale solution is
16 very similar. There's a couple of solutions out
17 there being deployed in Europe already where it's
18 called a pantograph down that I believe was also
19 mentioned. There's an international standard called
20 3105 that most of the electric bus manufacturers are
21 starting to -- or agreed to adhere to so that you're
22 not trapped with a choice of manufacturer. Because

1 standards are going to be a key component of this
2 growth.

3 And make no mistake, the growth is
4 happening as you have seen from the market as well as
5 from Proterra's individual growth. The time is now.
6 It's happening across the U.S., transit agencies
7 across the U.S., and some of those things I showed
8 you were from Park City, Utah. We have customers in
9 Duluth. We now have customers in Chicago, Alaska,
10 and the south. So mountains, cold, heat, they can
11 all be handled by the electric bus, and the
12 technology continues to improve.

13 Thank you.

14 MS. EMILY BRUMIT: Thank you.

15 Kate, go ahead.

16 MS. KATE TOMFORD: Hi. I'm Kate Tomford.

17 I work at the CTA, and I really appreciate the
18 opportunity to speak today. So thank you to the
19 Commissioners for the invitation.

20 I spoke back in April, I think it
21 was, at the first policy session on EVs, and at the
22 time, we had an RFP out on the street. So I know it

1 was a real cliffhanger, and I appreciate people
2 coming back to hear the next chapter of our EV
3 story.

4 Just a snapshot of what our entire
5 bus fleet looks like. We have over 1,860 buses in
6 our fleet, so quite a bit bigger than Foothill and a
7 lot of the other deployments of electric buses around
8 the country. Two of those are currently electric,
9 and I'll talk a bit more about those.

10 We have 129 routes over 10,000 stops,
11 160,000 miles of service a day on our buses. We pay
12 almost 17 million dollars in diesel costs a year, and
13 we have seven bus garages that we are thinking about
14 as we figure out the scale of electric buses. So
15 it's a big operation.

16 Just to bring you up to speed on the
17 evolution of our electric bus deployment over time,
18 we've had two electric buses that are in service now
19 and have been in service for the last four years. We
20 started thinking about how to scale that number up a
21 couple of years ago, and we put out an RFP for
22 another procurement last year. The RFP asked for a

1 base order of 20 buses and 25 additional options, and
2 we specified that these would be en-route charging in
3 contrast to the two depot charging buses that we have
4 now.

5 The contract was approved by the CTA
6 board this past summer, and it went to Proterra
7 conveniently. You have heard about their buses. And
8 it was for the base order that we requested, 20
9 buses, and it does have the options for 25 additional
10 ones if we decide to go forward.

11 It also has five chargers that are
12 being installed around three different locations.
13 We'll talk about that. These are fast chargers, so
14 these buses will be charging on their routes at the
15 terminals of their routes. The delivery is scheduled
16 to start early next year.

17 We have five pilot buses that we'll
18 be running just to work out the bugs. We keep them
19 in service for three seasons to see how they work in
20 all conditions, and then we'll go back and we'll talk
21 about any changes if necessary, and then we'll get
22 the remaining 15 buses the following year, 2020, and

1 then we'll talk about scaling up from there. We have
2 the extra 25 options if things go well.

3 I wanted to provide a comparison
4 of how our two generations of electric buses work.
5 So the New Flyers, again, we have two of them in
6 the fleet. They went into service in 2014. These
7 are depot-charging buses. Their battery packs
8 are 300 kilowatt hours, and they have a range of
9 about 100 miles, and that's what they're reported to
10 run.

11 We have tested that. It pretty much
12 lived up to its billing, and we've decided that 80
13 miles is a comfortable distance for us to run them in
14 service, just to have a cushion to get back to the
15 garage. The power of their charges is considered
16 slow charging. As Kent mentioned, in the consumer
17 role, it might be fast charging, but it's 100
18 kilowatts, and that's slow charging for us.

19 We run them in a.m. and p.m. rush
20 times, but they do go back to the garage in between
21 to charge for about three or four hours in the middle
22 of the day to repower, and then they come back at

1 night again and charge overnight.

2 But the beauty of them is that
3 they're flexible, so we can really run them on any
4 routes. They don't need charging along their route,
5 so they can just go out and provide service on
6 essentially any route.

7 The Proterras that we're getting will
8 be a fleet of 20 initially, as I said, going into
9 service starting in 2019. These will charge at the
10 terminals of their routes, and the first route that
11 we're electrifying is Route 66, which is the Chicago
12 Ave bus some of you might be familiar with. It's one
13 of our 24/7 routes.

14 And it charges on the east side of
15 Navy Pier, and then runs about 10 miles to the west
16 and charges at Chicago and Austin. That's the other
17 turn around. The battery pack on these buses is
18 440 kilowatt hours, and we don't know yet what the
19 range will be in our conditions, but we're
20 anticipating it will be over 100 miles. I have seen
21 estimates between 70 miles and up to 140 or so, but
22 we'll see.

1 But since they are charging en route,
2 in theory, we can just charge them at the terminals,
3 top them off, and keep them going all day, all night
4 long, but we'll have to practice that in actual
5 operating conditions.

6 The chargers are 450 kilowatts. So
7 at the time when we spec'd these, that was about the
8 highest power available on the market. We've now
9 heard that there are 600-kilowatt chargers available,
10 and, perhaps, we might upgrade to those at some
11 point.

12 Because these are charging along the
13 route, they have a fixed route essentially. They
14 have to charge on the routes where they have the
15 chargers installed at the terminals.

16 I wanted to mention a few of the
17 constraints we thought about as we selected Route 66
18 and the Navy Pier charging terminal specifically. So
19 we looked at the operating constraints of the routes,
20 themselves. We wanted the buses to be charging at an
21 indoor garage, so we looked at routes where buses
22 were served by those indoor garages. Five of our

1 garages are indoor. Two are outdoor.

2 We looked at the route lengths to be
3 sure that the length of the route and the time that
4 it takes for the bus to run that route with Chicago
5 traffic and construction and everything would be
6 appropriate for the mileage range of that bus.

7 We looked at layover times at the
8 terminals. We are anticipating that we'll operate
9 these buses by topping off at the terminals for five
10 or ten minutes, so we need a layover time that will
11 accommodate that time at the charger; otherwise, we'd
12 have to entirely rework our schedule.

13 We looked at bus accumulation. So
14 that's how many buses are waiting at the terminals to
15 go out during that layover time. So you can imagine
16 if three buses are waiting, you have to have a
17 terminal that size to allow those three buses to pile
18 up there and be able to charge.

19 And then we looked at scalability for
20 E buses. So we wanted to pick a charging terminal
21 that would allow other routes to be served as we
22 scale up, not just the Route 66.

1 In terms of the aspects of the
2 turnaround, the physical layout, we looked at the
3 ability for CTA to do construction. So do we own the
4 site, or do we have the ability to do construction
5 there.

6 Available space. Is there space to
7 put a charging station in? Can the bus pull up to
8 the curb, parallel to the curb so it can be aligned
9 under that overhead pantograph in order to get
10 charged? Is there enough space for another bus to
11 pull around in a bypass lane? Those were all
12 things we looked at looking at the shape of every
13 terminal.

14 Lastly, policy considerations. We
15 wanted this to be a visible location. We were
16 thinking about equity concerns in terms of which
17 populations in the city would be served by the
18 electric buses. Environmental justice locations
19 around the city. Tours and education were extra
20 add-ons.

21 This is a schematic or a rendering of
22 the Navy Pier location where we're planning to

1 install the chargers. This is looking toward the
2 southwest basically. You can imagine you're standing
3 in the lake when you're looking at this. The
4 Children's Museum is to your left, and Lake Shore
5 Drive is to your right, and you can see locations 1
6 and 3 are where we plan to install the first two
7 chargers, but we have designed this to accommodate
8 eventually up to eight chargers.

9 And that new building there is
10 essentially a substation, because as the gentleman
11 from ChargePoint mentioned in the first panel, we
12 will have potentially over 4 megawatts of power needs
13 at this location. It's expensive. It's really
14 expensively. This is a 32 million dollar contract
15 for a base order of 20 buses.

16 In thinking about scaling up, we are
17 trying to tackle two big questions in our mind. One
18 is what the right mix is of depot charging and
19 en-route charging. The second big question is how
20 can we effectively install charging infrastructure
21 to constrain the costs and to maintain its low
22 costs.

1 I don't have a lot of time to get
2 into all the details here, but suffice it to say,
3 there are many trade-offs in terms of thinking about
4 the range of the bus, the power of the chargers.

5 Obviously, the costs of installing
6 infrastructure out in the field at the terminals is
7 really high compared to in the depots, but there are
8 benefits to both, and we'll have to see as we go
9 along and actually put these buses into service
10 what makes sense for CTA considering our space
11 constraints and the whole range of routes that we
12 have to serve.

13 And I think Andrew is going to touch
14 a little bit more on questions about how we actually
15 manage our charging costs in terms of the demands
16 charges that we're seeing and the time management
17 aspect of it.

18 Thank you.

19 MS. EMILY BRUMIT: Thank you, Kate.

20 Lisa?

21 MS. LISA JERRAM: Thank you. That's how
22 you can contact, Kate. That's me. All right.

1 I'm Lisa Jerram. I'm the Director of
2 Bus Programs at the American Public Transportation
3 Association, APTA. And what I'll do in these slides
4 is I'll go through kind of -- to really give you the
5 big picture of what's happening overall in transit,
6 you know, sort of at the national level. And it's
7 going to reiterate some of the points that have
8 already been made, which I think is good, because it
9 gives you the sense of what's happening right now
10 with electric buses.

11 And then I'm going to go through --
12 it's almost sort of like a laundry list of some of
13 the challenges that transit is facing just as kind of
14 generating thoughts about where it could use some
15 support potentially.

16 So I won't spend too much time on
17 what APTA is. Essentially, we're a membership-based
18 association. We represent public transportation
19 interests in the United States. We have a lot of
20 members across the industry. So it's transit
21 agencies, operators, authorities. It's nonprofits.
22 It's academics. All of the business interests in

1 transit. So a wide range of members of APTA. We're
2 based in Washington, D.C.

3 Okay. So one thing I want to do is
4 put this a little bit into some context about
5 transit, and actually, bus transit in particular.
6 Just to give you a sense of where transit tends to be
7 on clean fuel.

8 So sustainability is really a core
9 part of what transportation does. It's a key part of
10 its mission. That manifests in a number of ways,
11 different initiatives, but certainly, one of them has
12 been that bus transit has been a leader in adopting
13 clean fuels or alternative propulsion technologies,
14 and it's really been a bit ahead of the game in many
15 ways for light duty vehicles on some of these
16 technologies. It's a little different. There's some
17 interesting stats -- I believe it was Kent that
18 mentioned it -- relating to the bus, the electric bus
19 side.

20 But basically, you can see in this
21 chart, it's the 20-year picture of the entire bus
22 fleet of APTA members and their fuel types, and the

1 purple one is diesel. So you can see that diesel has
2 been in dramatic downturn in terms of the percentage
3 of the total fleet. So we're already moving away
4 quite rapidly from diesel as the primary fuel for
5 buses.

6 Most of the other technologies,
7 though, are hybrids, diesel hybrids, natural gas, and
8 biodiesel. So electric buses kind of fit right into
9 that. They're a pretty small part of this picture,
10 though, right now, as we've kind of been talking
11 about a little bit.

12 I think this is the same chart that
13 you had.

14 MR. KENT LEACOCK: I got it from you.

15 MS. LISA JERRAM: Oh, you got it from us?
16 Well, I want to also give credit to -- there's an
17 organization called CTE that does the survey. So
18 they put out this chart, and so we both got it from
19 them.

20 But again, obviously what it's
21 showing you is this kind of -- what am I trying to
22 say -- inflexion point as of about 2014 in the growth

1 of this market. I think our estimates are that
2 there's somewhere between 300 and 400 maybe battery
3 electric buses in total in operation in the U.S.

4 But then, you know, the orders, the
5 awards for electric buses have up-ticked
6 dramatically, so that's accumulative as of 2018.
7 They're showing about 1600. So a rapid growth in
8 this market.

9 Now, it's still a pretty small
10 percentage of the total bus fleet, but as already
11 said, it's a very significant part of the new bus
12 orders that are coming out. So that's -- oh, wow. I
13 didn't even know I'd done that. Who knows what other
14 fancy, sort of animations I might have coming along.

15 So basically, there's 300, 400
16 battery electric buses. The key things, as has
17 kind of been mentioned, though, is the number of
18 agencies placing very large orders. A lot of them
19 are in California. California is ahead in many
20 respects, but that's driven by the state government
21 there.

22 But it's not just California. It's

1 New York City. It's Seattle. It's Portland. It's
2 Chicago. There's a lot of other parts of the country
3 now that are looking at making larger orders of
4 battery electric buses.

5 And then we have all those agencies
6 again that were pointed out earlier that are
7 committing to go all electric by 2030, by 2035, by
8 2040 typically are the dates.

9 One really important thing to think
10 about is that a bus in the U.S. is going to be in
11 service for 12 years minimum. So if you're going to
12 go all electric by 2035, that means that you don't
13 buy any more diesel buses after 2023. That's five
14 years. That's not very long.

15 So that's really quite a fast
16 potential growth rate for this market, and so we'll
17 be seeing some agencies having really significant new
18 numbers of buses, hundred-plus buses. Plus, it
19 really is spreading across the U.S., and there's
20 many, many agencies now that are looking at adopting
21 electric buses.

22 So that's kind of the big picture of

1 everything that's happening. But then -- so this is
2 I was just kind of giving you a brief idea of why
3 this is happening, and we kind of talked about some
4 of this. Certainly some of this is kind of, you
5 know, policy driven, policy push, if you will.
6 That's certainly true in certain states. It's true
7 in California.

8 And then there's incentives
9 available. Some of the growth in the recent battery
10 electric bus awards comes because of the FTA
11 providing the low-note grants to offset the price
12 premium for the buses. But it's also the case that
13 agencies really expect that these buses should cost
14 less to operate. The fueling should be less
15 expensive, and the maintenance should be less
16 expensive, and that's a really critical part, I
17 think, of making this long-term case for battery
18 electric buses for transit, and that kind of gets
19 into sort of the things we were talking about in
20 terms of complications of, you know, what kind of
21 charging do you have and how do you operate the buses
22 and how do you manage all of that new power demand.

1 That's a really critical piece, I think, of making
2 this all work over the long term.

3 So I won't go too much into this
4 stuff, because we've already -- I think you've all
5 seen what we're talking about. Essentially, it's
6 sort of been said. There's two types of buses
7 available essentially. There's the ones with the
8 smaller batteries, and they've tended to be the ones
9 that have the en-route charging. So you go on the
10 route. You get a shot of high power. That's not a
11 very technical term, but that's sort of how it
12 works.

13 Now we're moving more towards the
14 buses with bigger batteries, longer ranges so that
15 they can essentially kind of do what diesel buses or
16 CNG buses or hybrid buses do today. They won't
17 actually be a direct one-to-one replacement, which
18 was an issue for transit, but they will operate
19 similarly. They'll run their routes and then largely
20 be charged in a depot.

21 Again, this kind of runs through the
22 different types of charges that have been talked

1 about, depot-based charging, en-route charging, and
2 then actually what we've seen a lot of really is a
3 mix of those two, which again I think was mentioned
4 before. I think you talked about that.

5 You know, you want to do most of your
6 charging in your depot at night, but you'll have
7 opportunities along your routes to charge, and then
8 extend the range during the day.

9 So all of that leads to what are the
10 things that are happening that are kind of still a
11 challenge. Because there's a lot of excitement.
12 There's a lot of interest. There's a big push for
13 this, but quite honestly, the roadmap for really
14 large scale battery bus deployment is still very --
15 it's being worked out, let's put it that way. The
16 pathway is not 100 percent clear, and it may be a
17 little bit different for different agencies.

18 So you have challenges in terms of
19 the upfront cost of the buses. Certainly, they're
20 still more expensive. And how long do we count on
21 the FTA loaner grants to kind of support a large
22 expansion of the bus population.

1 Understanding the range of the buses
2 has been talked about a little bit and making sure
3 that you are really getting an accurate assessment
4 of the range, so you know how they're going to
5 work in your operations, and then all the other
6 things you talked about, which is selecting the
7 appropriate routes. And it's, you know, kind of a
8 complicated puzzle in some respects that has to be
9 put together.

10 And then the infrastructure part of
11 it is quite new for a lot of transit agencies. It's
12 a very different kind of way of providing your bus
13 fuel, and it's unfamiliar. So there's kind of a
14 learning curve on how you're going to do that.

15 So specifically related to challenges
16 around electricity as a fuel. Kind of, you know,
17 there's so many different things about this that I
18 think are again kind of new for transit agencies or
19 at least for the bus side.

20 Agencies that run rail services are
21 well-familiar with having to use electricity, but for
22 the bus side, often it's something that's a little

1 bit unfamiliar. It's getting down to understanding
2 the different types of electricity rates, time of use
3 rates.

4 Certainly, the demand charges are a
5 very critical thing and understanding then how do you
6 actually manage all that and how do you optimize the
7 way your buses are charged and the way they're
8 operated so that you do get those fuel cost savings
9 that you really want to have.

10 And then there's just working with
11 your utility. I think that's new for many agencies.
12 It can be.

13 Another interesting thing I think we
14 find coming up a lot with agencies is training. So
15 now you have your maintenance staff working with
16 high power, and that's something that's going to have
17 to be -- that we just kind of need to develop a
18 training system for a lot of the maintenance staff in
19 transit.

20 The big thing really is -- okay.
21 We're moving to large scale. A lot of these
22 challenges, it's a little bit simpler when you're

1 talking about five buses or ten buses. Now we go to
2 big, large scale, large deployments.

3 This is where I think all of the
4 challenges really become critical, and you really do
5 require collaboration among a lot of different
6 entities, the bus manufacturers, the agencies,
7 government, regulators, utilities, other charging
8 companies, and others to make sure that this really
9 can work and be successful, because there's a lot of
10 enthusiasm. I really see that. We want to make sure
11 it's successful, and that that enthusiasm -- you
12 know, it bears fruit in terms of really good, really
13 high quality electric bus deployments.

14 So I think that's really it. I have
15 one other slide, but it's more on the utility side,
16 so we can skip that one. There we go.

17 MS. EMILY BRUMIT: Thank you, Lisa.

18 Andrew?

19 MR. ANDREW BARBEAU: That's me. All right.

20 So I think I will run out this group.
21 I will try to do it quickly so we make sure we can go
22 into our break on time.

1 What I'm going to talk about today --
2 is that better? All right. I think I could have
3 done it. I think they could have heard me.

4 I'm going to talk a little bit, kind
5 of actually following up on that last question. What
6 does transit electrification look like at scale.
7 What does it look like when we are trying to address
8 an entire region, entire transit system's bus system.

9 And so we took a look at CTA, Chicago
10 Transit Authority, and they've already started this
11 route, going on this path of electrification. It
12 will probably take a number of years before they get
13 to something that is at scale, let alone 100 percent
14 electrification of buses.

15 But I want to take a look at this
16 core question. If we do electrify transit, if we do
17 electrify these buses, if we do electrify medium,
18 heavy duty fleets of vehicles, can our grid handle
19 it. Is this something that's going to cause
20 significant problems on the grid from creating new
21 peaks, creating new demands on the system. They'll
22 be costly for customers or something that can lead to

1 increased pollution from power plants by requiring
2 more and more fossil plants to stay online.

3 And so if we're trying to get some of
4 these benefits from electrification of buses, and you
5 look at what's on the screen here is some of the
6 routes of the CTA buses right now. It's not just
7 overall carbon and systemwide environmental benefits
8 that we can get from here. I think there's also, as
9 the CTA mentioned, it's kind of an environmental
10 justice and equity screen as well.

11 Where are the diesel pollutants
12 impacting communities where you already have high
13 penetrations of medium and heavy duty vehicles going
14 around, near rail yards where you're also getting a
15 lot of air pollution causing asthma and other
16 impacts.

17 So there's a need to accelerate this
18 pretty rapidly throughout the system. The question
19 is, can we handle it.

20 So we have up here some of the
21 numbers from CTA. 862 buses, how many daily bus
22 miles. You'll notice these are the same numbers that

1 Kate had on her slide. I just put it on a nice,
2 pretty map.

3 One of the key things on the bottom
4 there is if you were to electrify the entire bus
5 system, it's estimated to be about an extra
6 235 million kilowatt hours used by the transit
7 system. Now, as an electric rail system, they're
8 already using a significant amount, closer to around
9 400 million kilowatt hours of electricity already,
10 which is massive. So it's about a 54 percent
11 increase, but they know how to deal with electricity.
12 They're not just a bus only system.

13 So that seems like a significant
14 impact on the grid, but it's not just how much over
15 time. It's how much at these peaks.

16 So the first calculation I think
17 folks have been trying to crack here is how much do
18 you do depot charging, charging back at the garage,
19 versus how much do you do en-route charging. Right
20 now, it's primarily being dictated by the route,
21 itself, the range of the route, how much that bus
22 needs to travel.

1 And so we looked at CTA's system. We
2 looked at -- CTA has done some of this analysis in
3 the recent past to see what would it take. If you
4 look at the range of the vehicle that -- where they
5 currently are at, looking at a 100-mile-range
6 vehicle, you're pretty much probably limited to
7 electrify -- if you have 80-mile trips or less,
8 you're looking at probably more of a depot approach.
9 That means charge back at the garage and have
10 en route for a good portion of the day. If it's
11 longer than that, you're probably looking at
12 something that is a fast charging, en-route charger,
13 which may not ever be charged at a depot and could,
14 in theory, go perpetually.

15 Within the CTA system, there are
16 about 850 buses that fall into that 80 mile or less
17 category. About 900 buses that are greater than 80
18 miles and would require probably an en-route charging
19 and current technology.

20 What does that mean? We talked about
21 depot garage is a slow charging, slow capacity of 100
22 kilowatt chargers, or the en route that was described

1 earlier, 450 KW and greater.

2 So this is kind of the scale. How
3 would you start divvying up. If you are looking at
4 the depo charging, looking at the garage charging,
5 Kate mentioned there's seven different garages
6 currently. This is kind of the capacity to that.
7 This is kind of the mix of indoor and outdoor
8 garages. Some of the smaller numbers, I think, are
9 the indoor garages primarily, and it gives a little
10 bit of a mix.

11 But you see they're located
12 throughout the city, but this is a key point, that
13 these are clustered in significant places. You don't
14 have garages of 10 or 50 at a time. They are kind of
15 concentrated in specific areas, which means if we are
16 thinking about doing a significant amount of charging
17 now at these garages, that is a very localized impact
18 on the electric grid.

19 So we took a closer look at the
20 Kedzie garage, which is in the East Garfield Park
21 neighborhood, the West Side of Chicago right near
22 the -- I believe just south of the Kedzie Green Line

1 stop if I'm correct on that.

2 We said what -- you know, we used
3 some analysis that the CTA had looked at already to
4 say the buses that are located there, which are being
5 used for routes of 80 miles or less. We said, if
6 those are, you know, the classification where we have
7 to charge them at the garage, what would it look
8 like?

9 So about 84 buses fell into that
10 category within that garage, and so you put them out.
11 You looked at when they were leaving to meet their
12 scheduled service, when they were returning to the
13 garage, and you can see the orange bars up there are
14 when they have to go out and when it gets down to
15 nothing, that's when they're coming back in.

16 If you generally just charge -- you
17 know, the driver pulls up, plugs in the charging
18 station, sets it to go, and then it charges until
19 it's done, you see, kind of, the grid impacts that
20 those individual garages would have for those 84
21 buses. It would be close to 5 megawatts, 5,000
22 kilowatts of peak that you would see in the morning,

1 and then, more importantly, in terms of overall
2 coincidental peaks on the grid, you'd see another
3 3500 KW in the evening as these are coming off the
4 evening rush right when we're seeing a possible
5 growth of electrical use out in the residential
6 sector. This is something that could have pretty
7 significant impacts on the grid, which is rightly
8 concerning.

9 But if you take a look at it a
10 different way and say, let's think about not just
11 plugging them in as soon as they get into the garage,
12 but instead saying, just make sure they're ready and
13 100 percent by the time they need to leave. Then
14 you have a little bit more flexibility with when and
15 how much these are charging and being used on the
16 grid.

17 If you did that approach and focused
18 on having them ready to go when they're needed to and
19 be able to shift that load around, you'll
20 significantly reduce those peaks. You shift that
21 morning peak that was in the 9:00 a.m. timeframe
22 completely to overnight around midnight, and in the

1 midday, you're kind of right in that 11:00 to noon
2 area, and you eliminate that evening peak altogether.

3 So just by managing the charging of
4 this at this one location, you're able to cut the
5 peak in half. And also, more significantly, when
6 that peak is occurring is cut significantly.

7 The last thing we want to look at
8 here was -- okay. It's a big block of a roof in the
9 middle of the city. There's a significant
10 opportunity here for maybe also integrating some
11 distributed generation with that facility. Though
12 CTA would probably correct me and say that the
13 structural soundness of that roof probably couldn't
14 handle solar, let's just pretend that it can or
15 they're going to find somebody to replace it.

16 (Laughter.)

17 MR. ANDREW BARBEAU: So there's an
18 ability to install a significant amount of solar on
19 this, you know, large garage, flat roof system. We
20 estimated that you put -- you know, it says it can
21 handle up to 2.5 megawatts. We estimated about 1.9
22 megawatts. Obviously, less than a 2 megawatt

1 distributed generation cap that could be on this
2 system.

3 And if you look at at that point
4 installing an additional 1.9 megawatts of solar to
5 handle what is now a coincidental solar-forming
6 charging profile, you have that opportunity.

7 Similarly, if you see those shaded
8 buildings around it, this is something where you can
9 also look at maybe it doesn't all have to be on the
10 roof of the system. Maybe it can be on the feeder
11 nearby.

12 This is in the East Garfield Park
13 neighborhood of Chicago, Homan Square, and there's
14 significant neighborhood and community efforts to
15 look at what do eco districts look like, what does
16 community solar look like, what does this New Solar
17 For All Program look like, and how can they
18 potentially benefit.

19 If you're able to create a locational
20 investment in those areas to offset what is also
21 creating environmental benefit, you layer those
22 policies together, you could possibly achieve even

1 better results. And so if you paired that 1.9
2 megawatts of solar with the managed charging that
3 we're seeing as well, you're able to almost -- you're
4 able to minimize that midday peak to less than --
5 it's about 1.2 KW around noon with the solar helping.
6 Still, you have an overnight peak going there, but
7 that's when our rates in Illinois are very low and
8 often negative. You're able to fill in a lot of gaps
9 on the distribution system, avoid a significant new
10 introduction.

11 There's a significant less impact on
12 the distribution system than you would see if you
13 just did a dumb charge and set it and forget it kind
14 of mode. So if you look at layering and integrating
15 these different approaches, you could have a much
16 better impact.

17 And what it doesn't show, because it
18 goes down to zero, is solar is also providing a
19 significant reduction now for the afternoon. It goes
20 below zero. It's providing energy back to the grid,
21 which could also be helpful to handle some other
22 things that might be happening.

1 Now, what I didn't look at is the
2 rest of those buses, the 914 buses that would
3 probably have to go en route. Some of those, you may
4 be able to supplement with a midday charge and bring
5 into primarily a bus garage to be able to go longer
6 than the 80-mile limit. But if you were to do that
7 914, we're looking at now a distributed impact of 914
8 buses out on the route. You have this 500 KW of
9 charge for ten minutes at a time, about 83 kilowatts
10 hours per charge, and estimating based on how far the
11 buses travel per route, it's probably about 70
12 percent of the buses charging per hour, and if
13 they're all charging at the same time, you could
14 potentially have a 300 megawatt peak added to the
15 grid distributed at -- you know, I don't know how
16 many places throughout the city. You probably have a
17 couple of hundred places throughout the city, but
18 they're likely not all charging at the same time.
19 But if they are kind of balanced across that, you're
20 still looking at about a 50 megawatt increase in
21 load.

22 So finding ways to add to more depot

1 charging, supplement depot charging, so you don't
2 have to go all en-route charging is going to be a key
3 to figure out how to do this at scale.

4 So I just wanted to give you a little
5 sense of what does it look like in a real sense in
6 Chicago, what is the impact to the grid, and how can
7 we use it in complement with some of the other
8 policies we've set Illinois on a path to.

9 That's all I've got.

10 MS. EMILY BRUMIT: Thank you, Andrew.

11 On behalf of the Commission, I would
12 like to thank our presenters for educating us on the
13 challenges and opportunities presented by
14 electrifying the public transit sector.

15 We have about 15 minutes for Q and A,
16 and anyone feel free to take the first question.

17 How will deployment of electric bus
18 charging infrastructure change as more fleets are
19 added in cities across the country? Is there enough
20 space currently in the City of Chicago to develop bus
21 charging infrastructure in the areas that the buses
22 will be used most?

1 MR. KENT LEACOCK: I'll give it a shot, but
2 I think he might have a better answer than me.

3 But I think it's really a logistical
4 problem. I think Roland can address it in terms of
5 physical space versus the size of the yards,
6 et cetera.

7 The technology of pantograph,
8 overhead charging, hands free, allows for a better,
9 let's just say, space and size ratio in terms of
10 charging, but I think it will be a challenge, and I
11 think that the current spaces that are out there will
12 probably -- you'll probably need a little bit more
13 space. I just don't see how you could possibly
14 squeeze it all in without that. That's just my
15 opinion.

16 MR. ROLAND CORDERO: I think one of the
17 things that each transit agency needs to look at is
18 your routes and when do you charge the buses.

19 So if you have a bus yard that
20 accommodates 900 buses, do you really need 900
21 charging stations. Especially when you use a
22 pantograph, you'll be able to pull buses in when they

1 come back from their peak routes.

2 You really need to take an
3 opportunity to look at when buses return to the yard.
4 You have to allocate time for cleaning and washing
5 the bus as well as vaulting and taking the money out
6 of the fare box. So that has to be taken into
7 consideration.

8 And creating a time frame when buses
9 need to be charged, and you need to utilize a battery
10 management system so that you know when buses have a
11 full charge and kind of teach your dispatch which
12 buses can be deployed into service. I mean, there's
13 a whole new consideration for the whole operation
14 side of buses as well, and in deploying them and
15 dispatching them just more than just the
16 infrastructure, itself.

17 We moved away from en-route charging
18 because we felt that en-route charging was
19 inflexible. The way we deploy buses, we deploy them
20 on any route at any time of the day. We don't
21 specifically assign buses to specific routes and
22 operate those routes day in and day out.

1 We found that using en-route charging
2 was so expensive. It cost us a million dollars each
3 to build those two charging stations.

4 In L.A. County, it's hard for us to
5 find a location to build transit centers. Because
6 you don't want those charging stations on street side
7 or bus stops because their height clearance is only
8 11 feet 9 inches tall, and you have shipping
9 containers that pass by, you know, trucks with
10 shipping containers that need a clearance of at least
11 13 feet 6 inches.

12 So I think there's a whole new
13 consideration in terms of infrastructure space. Bus
14 yards weren't designed to accommodate charging
15 stations. That technology wasn't there when those
16 bus yards were built.

17 I know that there's one facility in
18 L.A., Antelope Valley Transit Authority. They do
19 have the capability to put pedestal-mounted chargers.
20 They have a yard that -- I think it's about 12 acres,
21 the size of their bus yard, and they only have a
22 fleet of 85 buses. So for them, it will be a lot

1 easier, but for us, Foothill Transit, it's tough.

2 MR. KENT LEACOCK: Land is inexpensive
3 where they are.

4 MS. KATE TOMFORD: I mentioned one of the
5 considerations that we had when we looked at which
6 routes to electrify first was whether the terminal
7 was shared among several routes.

8 So Navy Pier is a good example
9 actually. There are five different routes that use
10 that terminal, so we very deliberately decided to
11 invest there with the thought that once the
12 Chicago Ave bus is electrified, we can move on to
13 electrifying the Grand Ave bus, which is 65. The
14 Number 29, State Street bus, is another one that uses
15 that terminal and has high volume.

16 So we're trying to invest in a way
17 that we don't have to build new every time we want to
18 electrify a big route. That's one thing.

19 Also, we talked to ComEd very early
20 in the process to make sure that the feeders were
21 adequate and we have enough capacity there to do the
22 upgrade to service cost effectively. For us

1 actually, it just required a deposit to do design for
2 ComEd, but we're not actually paying ComEd anything
3 because service there was already adequate. So
4 that's another thing I would say is to utilize areas
5 where ComEd already has extra capacity, excess
6 capacity.

7 Then I also want to just mention
8 we're thinking about ways that we can coordinate with
9 other fleets so Pace is the obvious one where there
10 are terminals that we can electrify that also have
11 Pace routes. So when Pace starts getting EVs into
12 their fleet they can utilize the same terminal.

13 With the VW settlement, there's been
14 a lot of discussion of electrifying school buses.
15 They obviously have a different usage pattern where
16 they're heavily used in the very early morning, and
17 then they can sit around and charge during the late
18 morning and through the early afternoon.

19 So perhaps there are ways we can
20 coordinate with other institutions to try to make the
21 best use of all the infrastructure that we pay for.

22 MR. ROLAND CORDERO: I just want to also

1 add that when you're shifting over from -- for us,
2 compressed natural gas to electricity, you're buying
3 30 buses a year, you're obviously going to have still
4 compressed natural gas buses to operate.

5 So how do you transition your
6 compressed natural gas fueling station as you build
7 an infrastructure for your electric bus charging
8 station. Again, we're talking about space
9 constraints. You obviously can't shut down your CNG
10 compressors, build your charging stations, and not be
11 able to operate your remaining compressed natural gas
12 buses.

13 So the whole scheduling of how that
14 works out needs to be really considered as well.

15 MS. LISA JERRAM: A quick comment.

16 I think what this really highlights
17 of how much of what we're going through right now is
18 going to be a learning phase, and transit agencies
19 are going to be taking different approaches. It
20 will, of course, vary, as you said, on how available
21 land is, how expensive it is, all sorts of things.

22 I think it's important to keep that

1 in mind, that this is going to be an important phase
2 for transit agencies to understand how to do this,
3 and it will require then passing along what's been
4 learned to other agencies as they progress along the
5 same pathway.

6 MR. KENT LEACOCK: I was just going to say
7 that I found it interesting in Andrew's slide that
8 the bus yards, you know, as people have many times
9 said, they're right in the middle of neighborhoods.
10 So while this is complicated, you know, as people
11 say, we've been to the moon probably, and so I think
12 it can be --

13 (Laughter.)

14 MR. KENT LEACOCK: I think it can be
15 figured out. And down on the ground, you can't
16 stress enough how damaging diesel fumes, diesel
17 particulate matter, you mentioned social,
18 environmental justice issues that you were looking
19 at, and it truly is.

20 Because if you think about it, not
21 everybody can afford an electric vehicle. Bus riders
22 are riders of necessity generally, not choice.

1 That's slightly shifting. Millennials have become
2 much more frequent bus riders, but still, often
3 they're riders of necessity.

4 So I think it's important that the
5 utility commissions and commissioners look at who's
6 being advantaged by this transformation to
7 electrification. Not only can it be, if managed
8 properly, beneficial to the grid, but it can also be
9 beneficial to the health and well-being of the very
10 people that you're serving, especially now that often
11 kids ride transit buses versus riding school buses as
12 well for their means of transportation.

13 MR. ANDREW BARBEAU: I'll jump in on that
14 point. Another Illinois context is it could be
15 something that we consider going forward.

16 It could be something to consider as
17 we go forward. FEJA gives us some of the tools here
18 that if there's additional environment benefit we get
19 out of electrification, we're able to offset the
20 impacts on the grid of that with distributed
21 generation. We have the tools to create those
22 valuable investments in the grid and in the

1 communities.

2 MS. EMILY BRUMIT: Thank you for all of
3 your input.

4 Before I move on, do I have any
5 questions from our Commissioners or the audience?

6 Commission Oliva?

7 COMMISSIONER OLIVA: Thanks.

8 How might rate structure for charging
9 electric bus fleets evolve as more cities deploy
10 electric buses?

11 CHAIRMAN SHEAHAN: Can I offer an addendum
12 to this question? So the addendum is, how does
13 that relate to the issue that Kent raised about
14 ensuring that there's sort of an alignment between
15 the rate burden and the benefits in different
16 communities?

17 MS. KATE TOMFORD: I'll say one model that
18 we have right now is the railroad rate class, and the
19 railroad rate class contains two customers. You know
20 much more about this than I do probably, but the two
21 customers are CTA and the Metra electric line, and
22 that class is negotiated on its own.

1 And the Commission over the last,
2 let's say, decade and a half of cases that I have
3 read, at least, has been very supportive of the
4 argument that these two railroads operate for public
5 benefit and have a lot of environmental benefits and
6 that that justifies the lower rates that they're
7 awarded.

8 I believe that electric buses fall
9 into the same definition essentially. They're not
10 running on rails. They're running on roads. But
11 they are transit, publicly accessible transit, and
12 they're providing the same public benefits that our
13 railroads are.

14 So I think that could be one
15 example or precedent really for making the argument
16 that we should have discounted rates for electric
17 buses.

18 The demand charges that we pay for
19 facilities are between 6 and 7 dollars a kilowatt.
20 On our railroad class, they're around 3 dollars,
21 3.50, I think. So that would be, perhaps, the
22 discount that we could see if we were to create a

1 public transit bus class.

2 CHAIRMAN SHEAHAN: Would it be reflected in
3 lower rates to use the system?

4 MS. KATE TOMFORD: Oh, for fares? Yes. I
5 can't say really because there's so many other things
6 that go into our budget. So we --

7 CHAIRMAN SHEAHAN: That's always a risk in
8 Illinois; right? All the lottery money going to
9 education, you know, wasn't a net increase. It was
10 sort of, you know, a shell game really. I mean,
11 let's be honest.

12 MS. KATE TOMFORD: It's hard to say whether
13 that would be reflected in fares. It could certainly
14 offset other increases to fares if other factors were
15 causing fares to go up. But I don't know what the
16 net effect would be with all those factors in the
17 mix.

18 MR. ANDREW BARBEAU: I think it's a great
19 question, because it's not just the amount, but also
20 if you integrate a time component there as well, you
21 could actually incentivize some of this behavior and
22 get additional benefits from it.

1 I think using that as a tool for
2 adding a significant amount of new electrification on
3 the grid to push it off of peak to make sure it's not
4 creating new costs on the system, you're going to get
5 benefits for people even outside the rate class, the
6 regular electric bill payers, because you're eating
7 up a lot more kilowatt hours on the system. So
8 that's a general principle for all of
9 electrification.

10 MR. KENT LEACOCK: I thought that's where
11 you were going to go with rates. Because I think
12 that this is a load -- when he described the amount
13 of load that it would take at full electrification,
14 that's a load that could put downward pressure on
15 rates for all ratepayers in all different classes.
16 Because it's a previously unanticipated load, and I
17 think at 100 percent electrification, and you'll see
18 if -- as I noted, you have other electric bus
19 entities in the State of Illinois. It's going to
20 create a huge load that in the case of school buses
21 could be really advantageous during the middle of the
22 day.

1 And if you're starting to see
2 overgeneration at night, the fleets that are going to
3 be charging at night could take that off the grid,
4 add stability, and really benefit everybody and put
5 downward pressure on rates for everybody.

6 MS. EMILY BRUMIT: I think that's all the
7 time we have for questions. But thank you again for
8 everyone's participation, and I appreciate the
9 question from our Commissioners.

10 Can we please give Panel II a round
11 of applause?

12 (Applause.)

13 MS. EMILY BRUMIT: We're going to take
14 another short, five-minute break, and we'll see you
15 all back here then. Thank you.

16 (WHEREUPON, a five-minute recess
17 was had.)

18 ACTING COMMISSIONER PALIVOS: Okay. We're
19 going to begin, and, hopefully, Phil Jones joins us
20 at later time. Our next panelists will discuss the
21 current and potential -- sorry. Excuse me. We're
22 going to begin.

1 Our next panelists will discuss the
2 current and potential legal and regulatory framework
3 for electrification of commercial fleets and city
4 buses, both in Illinois and across the U.S.

5 To lead our discussion, I'd like to
6 introduce Ritta Merza, my other legal and policy
7 advisor here at the Commission.

8 Please join us in welcoming Ritta.

9 (Applause.)

10 MS. RITTA MERZA: Thank you, Commissioner
11 Palivos.

12 The purpose of this panel is to
13 discuss the current and potential legal and
14 regulatory framework for transportation
15 electrification; specifically, for commercial fleets
16 and public transportation.

17 The format of this panel will also
18 consist of brief presentations by each panelist
19 followed by a series of questions. If time remains
20 at the end, we'll open up the floor for audience
21 questions.

22 Before we begin, I would like to

1 introduce our panelists. On this panel, we will hear
2 from Commissioner Beth Trombold with the Public
3 Utilities Commission of Ohio; Rob Kelter, Senior
4 Attorney in Environmental Law and Policy Center; Matt
5 Stanberry, Vice President of Market Development at
6 Advanced Energy Economy; Tom Brotherton, Regional
7 Director at CALSTART; and last, but certainly not
8 least, Phil Jones. Hopefully, he will be here before
9 the end of this panel. He is the Executive Director
10 at Alliance For Transportation Electrification.

11 Please join me in welcoming our
12 panelists.

13 (Applause.)

14 MS. RITTA MERZA: Commissioner Trombold,
15 you're free to begin when you're ready.

16 COMMISSIONER BETH TROMBOLD: Great. Good
17 afternoon, everyone. I'm happy to be here.
18 Greetings from the Buckeye State.

19 And I get off the Blue Line just a
20 little bit ago, and who do I see but Commissioner
21 Rosales greeting me. We totally did not plan it, but
22 yet, he was there and I so appreciated his

1 hospitality of shepherding me here.

2 COMMISSIONER ROSALES: I take the CTA.

3 (Applause.)

4 MS. KATE TOMFORD: Thank you. I got a nice
5 Chicago welcome.

6 I'm here today to talk a little about
7 what's going on in Ohio, and I really appreciate that
8 opportunity because I'm learning a lot from what I
9 have heard today that's going on here in Illinois,
10 and I'll take that back with me.

11 We had an event that Ohio featured.
12 I don't know how many of you have heard of Power
13 Forward. Anyone? Oh, good. Great. We won't talk
14 about Rob.

15 Thank you. I appreciate that. So
16 anyhow, in the discussion about Power Forward, we did
17 have quite a bit of conversation about electric
18 vehicles, and I'm going to talk a little bit about
19 that. We issued a report recently, and there's also
20 some other things going on in Central Ohio having to
21 do with EVs, and I like to call it sort of a perfect
22 storm of things happening that's really kind of

1 generating a lot of buzz and a lot of movement in the
2 EV space.

3 So I'm going to get started with my
4 slides, and I'll be happy to take questions.

5 So I just wanted to kind of -- for
6 those of you that haven't or aren't familiar with
7 Power Forward, this is the report we issued. I have
8 a couple of copies with me if you want one. It's
9 available on our website.

10 Basically, why Power Forward? See,
11 Rob, I put a smart thermostat there just for you.

12 (Laughter.)

13 COMMISSIONER BETH TROMBOLD: I had to get
14 that in. Sorry.

15 Why Power Forward? Everyone knows
16 that traditional one-way grid now is
17 multidirectional, and so this discussion is taking
18 place. There's so many mobile applications. I like
19 to say the kids in college have never known a world
20 without the internet, and these are going to be our
21 future ratepayers. There's lots of ratepayers out
22 there that are looking for mobile applications, smart

1 homes, smart appliances.

2 There's a lot going on that's
3 changing the electric industry. So I wanted to have
4 that discussion and have a unified kind of approach
5 to the way we move forward with grid modernization in
6 our state, and that's why we embarked on this journey
7 called Power Forward.

8 So Power Forward is built on two
9 pillars, and the two pillars are innovation, both
10 regulatory and technology, and then also enhancing
11 the customer experience.

12 So I know here in Illinois you have a
13 similar type of grid modernization discussion, and
14 you find that the customer is an important part of
15 that discussion as well.

16 And what we told ourselves is why
17 have this discussion if customers aren't going to
18 benefit at the end of the day. So we had to make
19 good on that promise through our report.

20 Power Forward was conducted in three
21 phases over the course of the last year and a half.
22 That slide looks a little wonky, but as you can see,

1 there's three phases that start -- we kind of
2 developed this frontal approach where you start big
3 picture and kind of whittle it down.

4 We started with a glimpse of the
5 future, kind of building the business case for why
6 Power Forward was important, and then next we moved
7 on to exploring the technologies associated with it,
8 and finally, we ended with a two-week kind of
9 discussion about ratemaking and regulation. That's
10 when we talked about EVs.

11 We had 127 speakers, 100 hours of
12 testimony and education. Like I said, we did it in
13 increments. We talked with a lot of folks in between
14 each phase, and it was an all-hands-on-deck kind of
15 experience. We did it all internally organically
16 within our commission and our staff. We had no
17 outside parties writing it, leading us.

18 I will say the Department of
19 Energy and some other folks around the country were
20 very helpful as far as providing some input. We
21 looked at a lot of states for best practices and did
22 a lot of talking with our colleagues in other states,

1 too.

2 Here's the principles and objectives
3 that came out of Power Forward and our report. I
4 think the real important -- nothing too surprising
5 here, I don't think. Do no harm, provide net value,
6 create an innovative environment, enhance the
7 experience for all.

8 And then our objectives, we were told
9 at the very beginning, you can't have a smart grid
10 without a strong grid. So that was a really
11 important objective for us.

12 The grid is a platform. You have to
13 build that platform, that stage, that base before you
14 can make it smart, and you must have a robust
15 marketplace for things to further innovate and grow.
16 And we wanted to make sure we had the customers'
17 experience again in that objective.

18 So moving forward, I'm trying to buzz
19 through this because I know I'm not going to have
20 enough time.

21 CHAIRMAN SHEAHAN: You can have Phil's
22 time.

1 COMMISSIONER BETH TROMBOLD: I can have
2 Phil's time? All right. I'll take Phil's time.
3 He'll be okay with that.

4 So Power Forward and electric
5 vehicles. The one thing we talked a lot about was
6 how to start and address it on the grid and what's
7 going to happen with our grid associated with it. We
8 talked about there may be a justification for our
9 distribution utilities to participate while the
10 market develops, but we're very concerned about
11 making sure that competitive environment still
12 existed.

13 So we wanted to create some kind of
14 foundational support, but yet, provide an opportunity
15 for competition to take hold.

16 Obviously, electric vehicles provide
17 operational challenges associated with the grid. We
18 wanted to allow for recovery when that made sense,
19 and in terms of charging stations, we weren't really
20 that keen on being the ones in charge of the charging
21 stations. But again, we're willing to explore
22 recovery options for, like, corridors and

1 foundational types of infrastructure. So that was
2 important to us.

3 Again, talking about time of use
4 rates. We weren't in a position to decide where
5 those charging stations would be located, but we
6 wanted to partner with entities to kind of come up
7 with a comprehensive approach, and we wanted to help
8 facilitate utility involvement in that.

9 So we have partnered with a lot of
10 folks in the Central Ohio area in particular, not
11 only just AEP, but also our city government, our
12 Environmental Protection Agency, our Department of
13 Transportation, and so forth.

14 So in our report, we list our next
15 steps, and this is really hard to see. I apologize.
16 But you can look at it on line.

17 We're going to have a Power Forward
18 collaborative that's going to continue this
19 discussion about grid modernization, and just -- this
20 is new. It's all ready for prime time as far as --
21 we haven't really announced it, but I'm telling you
22 right now that we're going to be announcing more

1 information regarding these working groups in a
2 formal type of situation or order in the next month
3 or so.

4 We have given ourselves by the end of
5 the year to talk about the working groups and how
6 that would operate, but we're going to go and start
7 talking more about it in the next month, sooner
8 rather than later to keep the momentum going.

9 So here's the report. This is what
10 it looks like. You can download it if you'd like.
11 We made sure that it's a readable type of report. It
12 took a lot of work to keep it under 40 pages. As
13 you can imagine, these things are easy to write
14 mountains of paper and words, but to keep it short
15 and really to the point was difficult. It took a lot
16 of work.

17 All the Commissioners took part in
18 writing this report, something we're very proud of.
19 The Chairman of our Commission, Asim Haque, really
20 did a great leadership effort in getting us all
21 involved. So all of us had a portion of this report
22 that we personally wrote.

1 So I also wanted to talk about the
2 other activity going on regarding EVs in Ohio, and
3 we're part of the smart city challenge, and we've
4 also approved an AEP smart city rider that has an EV
5 component. We did that in April of this year. And
6 then also just briefly talk about the Volkswagen
7 Mitigation Trust Fund.

8 So like I was saying before, it's
9 sort of been a perfect storm of these things going on
10 relating to EVs that's really, I think, propelling
11 this whole discussion, especially in Central Ohio.

12 So the Smart City Challenge.
13 Columbus was awarded 50 million dollars through the
14 USDRT Smart City Challenge, and their goals are to
15 drive economic growth, quality of life, foster
16 sustainability, and improve safety. So the city of
17 Columbus is pretty much the one leading some of the
18 charge on that.

19 Then as I said, AEP partnered with
20 Smart City, and they came to us with a program they
21 wanted to implement regarding the Smart City rider,
22 and that's going to authorize some of the money for

1 charging stations to appear throughout the state or
2 their service territory. And Ohio AEP will serve as
3 the administrator. It's like a rebate program.

4 If you want more information about
5 that, I can certainly provide it. I am not an
6 expert, but I did talk with them, and I talked with
7 the EPA a little bit more about the programs, because
8 I think it's important to understand kind of what's
9 the big picture.

10 But just to recap it, there will be
11 Level 2 charging stations. We allocated 3.7 million
12 to be dedicated to 300 charging stations. They have
13 had a lot of interest. They just sent out, I think,
14 their initial RFP, and they've had a lot of people
15 applying. I don't know what the number is at this
16 point.

17 And then here, 5.8 million is
18 dedicated to 75 charging stations. Again, this is
19 through a rider that all customers pay for, but we
20 felt as though it was something that was important in
21 terms of jump starting the infrastructure associated
22 with EVs.

1 And then the lawsuit with the
2 Volkswagon, Ohio was awarded 75 million dollars over
3 15 years, and I talked with our department, our
4 Environmental Protection Agency, and, you know, they
5 talked a lot about how they're partnering and talking
6 with not only us, but the Transportation Department
7 with smart cities, and we're all trying to ensure
8 that this rollout and this money isn't duplicative,
9 that we're all talking to each other and making the
10 best use of the funds, and making it in areas that
11 make sense.

12 So Ohio specific -- so Ohio under our
13 plan, like I said, there's 75 million dollars, and
14 EPA is dispersing 11.25 for the zero emission
15 infrastructure. So we're coordinating with them, and
16 they're coordinating with Electrify America Utilities
17 and, of course, us and other entities. They are only
18 giving that money out to publicly available
19 locations.

20 And like I said, it's really
21 important to coordinate, because we don't want to
22 waste these funds doing duplicative types of things.

1 So communication amongst all these entities is real
2 important to ensure that we can have the best use of
3 the EV infrastructure in our state and that the
4 rollout of EVs continues.

5 Right now, we have about -- last I
6 saw, about 9,000 EVs in Ohio. There's 11 million
7 people. So it's not a real big number, I know,
8 compared to states like California and others, but
9 it's moving along and it's changing.

10 And that's about all I have for
11 today, so I'd happy to answer any questions after.

12 MS. RITTA MERZA: Thank you, Commissioner
13 Trombold.

14 Rob, you can start your presentation
15 whenever you are ready.

16 MR. ROB KELTER: Thank you. I really
17 appreciate the opportunity to be here. It won't come
18 as a surprise, those of you who know me, that I have
19 a lot of opinions about electric vehicles, and I'm
20 happy to share them.

21 I want to start out with a couple --
22 a few thoughts that are broader, and then I want to

1 talk about electric vehicle school buses.

2 So the first thing I wanted to talk
3 about is what's the right process for Illinois in
4 addressing electric vehicles, and because
5 Environmental Law and Policy Center is a regional
6 organization, I've had the opportunity to participate
7 in different processes in different states, and I
8 wanted to just briefly talk about those.

9 Michigan is really interesting,
10 because we started out with a rate case from
11 Consumers Power about three years ago, and we
12 challenged some of what they wanted to do. Well,
13 specifically, we challenged Consumers' ownership of
14 electric vehicle charging stations. So Consumers
15 just said, well, if we can't own the charging
16 stations, we don't want to do it, and they withdrew
17 the proposal.

18 Then the Commission had a series of
19 workshops, and now we're back in with two new rate
20 cases from Detroit Edison and Consumers where that
21 have new proposals that are much better thought out,
22 I think, because of the Commission's workshop process

1 that the Commissioners participated in.

2 You have heard a little bit about
3 Ohio. Giving you just a little bit more background,
4 in Ohio, before we had Power Forward, AEP actually
5 had a proposal for this electric vehicle charging
6 program within their ESP case. The Commission
7 approved the pilot program that Commissioner Trombold
8 discussed, and now through Power Forward, we've taken
9 a harder, broader look at this, and I think that's
10 worked out kind of well, because we're getting
11 started in a small way, but before we get much
12 bigger, we've got a larger process to discuss the
13 issues in a broader way.

14 So I think the question in Illinois
15 is what are we going to do here, how is this process
16 going to work, will it be led by utility proposals,
17 will it be led by the Commission, or will the
18 Commission just let me lead it.

19 (Laughter.)

20 MR. ROB KELTER: Just checking to see who's
21 paying attention.

22 CHAIRMAN SHEAHAN: You'd be welcome to.

1 (Laughter.)

2 MR. ROB KELTER: I think fundamentally,
3 having gone through a couple of years of going to
4 conferences, participating in different programs,
5 litigating cases, the single most important thing in
6 my mind and the ELPC's mind is that we want the
7 market to be as competitive as possible, and we also
8 think it's critical that there be interoperability
9 between the charging stations so anybody with any car
10 can charge at any station easily.

11 We do strongly believe that we should
12 limit utility ownership of charging stations. We
13 understand that in certain cases, certain communities
14 may not be well-served by the competitive market, but
15 the first thing we should do is see exactly what the
16 competitive market will serve.

17 We believe that utilities don't need
18 to own the charging stations, that there's plenty of
19 benefit to the utilities from electric vehicle
20 charging programs that include an increased sale of
21 electricity. That includes being able to rate base
22 the wiring and all the make ready that goes into it.

1 And we've also seen and we're seeing
2 it in Michigan now, where the utilities have said,
3 all right, well, if we can't own the charging
4 stations, then we want to rate base the rebates.

5 And our position is that that's
6 ridiculous, that there's no justification for
7 rate-basing rebates. They have always been an
8 expense for a reason. They're not a capital
9 investment, and they don't fit as a capital
10 investment, and we believe, given the opportunity to
11 give good reason why they should be considered a
12 capital investment, the consumers and DTE have failed
13 on that end.

14 We do believe that there may be some
15 room for performance incentives for utilities, but
16 they've got to be carefully crafted, and they've got
17 to really demonstrate that customers are getting
18 benefits from the utility's actions. So it's not
19 just that we've got a charging station program and
20 we're putting out 100 charging stations.

21 It may be something along the lines
22 of making sure that customers charge their vehicles

1 off-peak at night, which is a good segue way into the
2 next thing that I wanted to mention, which is that we
3 think that rate design is really important.

4 Time-of-use rates for charging
5 electric vehicles is critical. In Illinois, we've
6 got a real opportunity because of our excess capacity
7 at night, and we can be charging these electric
8 vehicles with wind.

9 The public charging is a little bit
10 less clear than individuals charging their cars at
11 home at night. I mean, we think about 80 percent of
12 customer charging will be done at night, but some
13 charging will be done in the public.

14 We believe that the first thing we
15 should do is test competitive pricing for public
16 charging. Now, we're okay with the utilities
17 charging the chargers time-of-use rates, but we
18 believe, for instance, if you go shopping at Whole
19 Foods and it's 3:00 in the afternoon and Whole Foods
20 wants to let you charge your car free and you need to
21 charge the car for ten minutes in order to feel
22 comfortable that you're going to get home okay, right

1 now, we think that's all right.

2 I think we need to see how the market
3 plays out, because we do want to be encouraging
4 people to charge off-peak. But for right now, we
5 believe that competitive charging should be allowed.

6 Another critical issue I wanted
7 to mentioned today is low income programs. We
8 believe that the first question to start with is what
9 kind of program will really benefit low income
10 customers. One of the other speakers, I believe from
11 Proterra, mentioned that a lot of low income
12 customers aren't going to be rushing out to buy
13 electric vehicles.

14 I think we need to reach out right
15 away to low income advocates to get feedback on them
16 on what is important to their community, but we're
17 not convinced that putting a lot of charging stations
18 in low income communities may make as much sense as
19 ride share programs or EV transit buses and, most
20 importantly, EV school buses, which ELPC is very
21 focused on, and that will be the last few minutes of
22 my presentation today.

1 We think there's tremendous potential
2 for EV school buses, and we've been talking about
3 this -- I don't know how many people saw this, but
4 ELPC did a tour around the midwest with EV school
5 buses. We worked with ComEd to do one of those stops
6 in Chicago.

7 But most importantly, we've been
8 working very closely with Ameren on this, and Ameren
9 has really been great to work with. They have been
10 very aggressive about their desire to promote EV
11 school buses.

12 And I think they share our belief
13 that they have a lot of value for a number of
14 reasons. One is that they can be lower cost. They
15 will be lower cost over time. While the buses cost a
16 lot more now than a typical diesel school bus, you
17 save so much money from charging and from lower
18 maintenance that the buses will, in fact, pay for
19 themselves over time.

20 But, also, there's money available
21 now through the Volkswagon settlement, and the
22 Illinois EPA has set aside 11 million dollars in the

1 plan for electric school buses, which we're very
2 excited about.

3 The benefits are numerous. In the
4 summertime, the buses can be charged at night and
5 then used as storage during the day just like any
6 kind of battery storage, except they're even better
7 because they can be driven to anyplace they're needed
8 to enhance the grid, particularly if there's storm
9 outages or things like that.

10 I just want to give you -- I've got
11 one minute left. I want to tell you a little bit
12 about what we're doing with Ameren, and through
13 Ameren's hard work, we set up a meeting in
14 Springfield with a number of school districts from
15 around Southern Illinois to broach the subject with
16 them and open a dialogue and start talking about how
17 to make a program work. And we believed it's that
18 kind of proactive attitude with working with school
19 districts and listening to them and helping them
20 try and get the funds that they need to buy these
21 buses, because the costs are a little bit more up
22 front.

1 So we're continuing to work with
2 Ameren and the school districts downstate, and we
3 hope to make good progress, and we hope to start
4 working with ComEd and Chicago on the same type of
5 program.

6 And I think my time is up. I know
7 what that red time thing means.

8 MS. RITTA MERZA: Thank you very much, Rob.
9 Matt?

10 MR. MATT STANBERRY: Thank you very much.
11 So first, thanks to the Commission and the
12 Commissioners for having us today.

13 My name is Matt Stanberry. I'm from
14 Advanced Energy Economy. For those of you who don't
15 know us, we're a multi-tech business association that
16 represents companies making the products and services
17 that make our energy and transportation system more
18 secure, clean, and affordable.

19 So I have run our Advanced
20 Transportation Program, which works with a number of
21 companies in the transportation electrification
22 space. We work with folks in the charging

1 infrastructure business, see them in screen lots,
2 EVgo, as an example, folks in the vehicle
3 manufacturing business all the way down to electric
4 carts for low speed neighborhood electric vehicles --
5 the folks over at Ingersoll Rand make those -- all
6 the way up into light-duty vehicles, Honda, Tesla,
7 and heavy duty, the folks at Proterra, BYD as
8 examples.

9 Then we work with a bunch of smart
10 grid companies that are focused on the integration of
11 these technologies, like Landis+Gyr, and we go into
12 fleet ownership and operations, UPS, Amazon, as
13 examples there.

14 And there are a bunch of other
15 technology companies. One of the things that we're
16 really seeing in this space is an explosion of new
17 ideas and technologies to facilitate different
18 efforts and elements of the EV market.

19 So as is abundantly clear from the
20 conversation today, this is a market that is really
21 rapidly growing. Just a fun factoid. We're, of
22 course, focused on medium-and-heavy-duty vehicles

1 here, just checking the light-duty space, because, of
2 course, this is all a connected industry in some
3 ways. The market is up 57 percent year over year
4 through August. So it continues to move at a very
5 quick pace.

6 But we know we're still at the early
7 stages. We have a young market. We have an exciting
8 market that's growing quickly. And as a result --
9 Rob was speaking to this a little bit. We're seeing
10 the regulatory community really start to pay
11 attention to this marketplace.

12 And I think, you know, if you had to
13 boil it down to two basic reasons, you don't want to
14 have a regulatory system that, frankly, wasn't
15 designed with EVs in mind, not surprisingly, do
16 things that inhibit the growth of a young and high
17 growth industry, but also because we know that
18 there's substantial -- there's quite a bit of
19 modeling out now that shows there's substantial
20 public benefit that can come from EV adoption and EV
21 charging if that charging is smart. And, of course,
22 early engagement in the regulatory arena can affect

1 charging behavior.

2 By our count, we have something like
3 19 different states right now that have some form of
4 EV regulatory issue on the docket or about to open
5 one.

6 So just a little bit later this week,
7 we'll actually be releasing a regulatory brief
8 covering a number of the issues that have been
9 discussed today and has a special call out for
10 medium-and-heavy-duty vehicles as part of it. So I
11 just wanted to give you a sneak peek at some of our
12 thinking in this space.

13 And first, germane to this
14 conversation today, is prioritizing
15 medium-and-heavy-duty vehicles, and these are low
16 hanging fruit with special characteristics that
17 provide a number of different value streams for
18 different parts of the population.

19 They also present the opportunity for
20 scale. We have highly rational buyers in this space
21 that obviously see the operational and fuel costs,
22 the fuel cost savings and the maintenance savings

1 from these vehicles.

2 They do have some particular
3 regulatory challenges, and they have some unique
4 characteristics. It's very different that these
5 vehicles have a high utilization charging. That's
6 pretty predictable relative to your light-duty market
7 where it's absolutely the opposite of that
8 circumstance.

9 I have to congratulate the ICC on
10 holding this conference today, because one of the
11 first things that we've concluded is that this topic
12 area needs to be highlighted within commissions
13 through things like holding a technical conference,
14 because, frankly, it does not get a lot of attention
15 in the regulatory space. We're starting to see that
16 change, but it deserves more, and events like this
17 are critical to that.

18 As you address each of the different
19 regulatory areas within the electrification space,
20 it's important to keep medium-and-heavy-duty and
21 fleet vehicles overall in the back of your mind,
22 because there are some important differences, and

1 I'll try to highlight a couple of those. So that's
2 number one, have some focus on medium, heavy duty and
3 fleet vehicles overall.

4 Number two, and you'll hear an echo
5 with a few of the things Rob said, establish an EV
6 process and really regulatory framework through an
7 open collaborative process. Open the docket, get
8 input from a wide variety of stakeholders. This is a
9 small -- you know, it's an innovative, relatively
10 small industry. Still, a lot of the players that
11 have the best information, they're small. So
12 adjudicated dockets can be hard for all of those
13 players to get into, and they have some of the best
14 information.

15 So open, collaborative processes are
16 very helpful.

17 And then establishing some Commission
18 views on some of the key regulatory issues in a white
19 paper or some other type of writing, such as the
20 Power Forward documents that have come out, is
21 incredibly helpful for reducing market uncertainty
22 for different actors in the space and facilitating

1 investment. That's one. That's the second item.

2 So is the third item is establishing
3 appropriate roles in EV charging infrastructure. We
4 do have a charging infrastructure challenge in the
5 country. We have a lot of people working on solving
6 it, but market data is pretty clear that we're behind
7 on the infrastructure side of things. Even in some
8 of the biggest markets, looking at California, we
9 have an infrastructure deficit.

10 Our view is probably a little bit
11 different, maybe a little bit more open than Rob's to
12 considering different ownership models that are out
13 there. I did hear something that we totally agree
14 with that Rob laid out, which is you have to look at
15 the different market characteristics within each
16 segment of the EV space.

17 In general, we think that the
18 principles that should be put forward are trying to
19 grow the EV charging industry and its deployment in
20 that market and making sure that there's access for
21 all, and I think there's a need for openness to the
22 different roles that both utilities and third-party

1 charging companies can play in that.

2 Fourth, adjusting utility planning
3 and operations. It's really important to start
4 thinking about incorporating EV-related loads and
5 forecasts and distribution system planning processes
6 and think about ways to, perhaps, streamline
7 interconnection processes.

8 One of the things that fleet
9 operators will tell you is that they sometimes will
10 have customers who buy buses and then are waiting for
11 a long period of time for interconnection processes
12 to play out, which with big assets can be a
13 particular challenge.

14 And also, another thing that's
15 important. This is different by utility, of course,
16 but establishing a point of contact with utilities
17 for EV-related work, particularly for fleets, because
18 sometimes you'll have these customers come forward to
19 utilities and get a blank stare back. You want to
20 create a depot? And there's a -- there's a need for
21 long-term education there. So establishing a point
22 of contact is very important.

1 And then the last is to Rob's point,
2 interoperability standards are incredibly important
3 for public charging stations so that everybody has
4 access to stations that have been paid for through
5 public dollars in part.

6 The next one, rate design, we do
7 think that the benefits of this space are in part
8 dependent on rate design, and that it's very
9 important to do a couple of things. EV-only rates
10 are very helpful for designing appropriate rates to
11 incent the right kind of charging patterns, and time
12 varying rates are incredibly helpful as well.

13 And then at the early stages of this
14 market, it's important to think about what we can do
15 in terms of demand charge relief under EV-only rates
16 to support the use of those charges.

17 And that is true for
18 medium-and-heavy-duty vehicles. There's a number of
19 discussions around. For example, a demand charge
20 holiday for certain hours of the day where demand
21 charge might be reduced or, in fact, eliminated for a
22 limited period of time.

1 All right. The last two quickly.
2 Customer education is incredibly important in this
3 space. The data on the market is very clear on that.
4 One of the things that we think is important is that
5 utilities do have a unique relationship with a large
6 swath of customers in states, and looking for ways to
7 leverage those relationships to just improve EV
8 literacy both on the vehicles but also the charging
9 of those vehicles is very important.

10 We'd point to examples in the energy
11 efficiency space where there are some practices that
12 have been developed over time that can be useful in
13 this space.

14 And then last, to Rob's point, pay
15 attention to vulnerable populations. Start that
16 outreach early. And think about ways that we can
17 improve services for those communities, provide more
18 access to transportation. Medium-and-heavy-duty
19 vehicles provide a particular potential there, but
20 also some fleet service pooling, those kind of
21 avenues as well.

22 So with that, I'll close down, but I

1 think thinking about those keys to the regulatory
2 framework really will help guide commissions towards
3 dealing with a very new space frankly that's outside
4 of a number of other topic areas that are the usual
5 that come before the bodies.

6 I think you need this.

7 MR. TOM BROTHERTON: Thank you. We've
8 learned that earlier today.

9 Okay. Good afternoon. I am the
10 final speaker on this session, and I really
11 appreciate the opportunity to be invited here today.

12 My name is Tom Brotherton. I work
13 at CALSTART, and we have been administering the
14 Drive Clean Truck Program on behalf of the City of
15 Chicago over the last several years. So I'm going to
16 walk through some of the design of how that program
17 works.

18 I think it's a great model for how
19 incentives for trucks and buses can be administered
20 here in Chicago and elsewhere. And then after that,
21 I'll give some more current observations just from
22 our deployment of trucks and buses in other parts of

1 the country.

2 So Drive Clean Truck is a
3 point-of-sale incentive. It's a voucher program.
4 The goal is to help move fleets to zero and low
5 emission vehicles. The program here in Chicago is
6 open to Class 2 to Class 8 trucks and buses.

7 If you're not familiar with that
8 terminology, Class 2 can include some of the heavier
9 pickup trucks and vans. Class 8 are the heaviest of
10 trucks that on are the road.

11 The program is open to all-electric
12 vehicles as well as hybrid trucks and buses.

13 The incentive program is funded by
14 the Chicago Department of Transportation, CDOT, and
15 administered by CALSTART. The money came from CMAQ
16 money if you're familiar with that term. That's
17 Congestion Mitigation and Air Quality, and it's a pot
18 of money that's open all around the United States,
19 and every metropolitan area or state gets a certain
20 fraction of that money based on a combination of
21 population as well as pollution severity.

22 And at the federal level, it's

1 administered by the Federal Highways Administration,
2 and then it gets divvied up around the country and
3 administered locally.

4 We started with 11.3 million dollars
5 of incentive funding which was given out for 288
6 trucks and buses over the course of 2015 to 2017 in
7 Chicago. It actually covered the six-county
8 metropolitan Chicago region. It wasn't just the city
9 proper.

10 And the vouchers covered about 80
11 percent of the incremental costs of these vehicles.
12 Meaning the incremental costs compared to a
13 baseline gasoline or diesel vehicle, we covered about
14 80 percent of the cost of the difference between that
15 baseline cost and its electric or hybrid counterpart.

16 The eligible vehicles had to operate
17 70 percent of the time, spend 5 percent of the time
18 in the six-county area. And the vehicle purchasers
19 had to comply for three years, meaning they would
20 commit to these terms and conditions for a period of
21 three years after the vehicle was placed into
22 service.

1 The program was run through a
2 web-based system where we had dealers in Chicago who
3 would request these vouchers through us
4 electronically. Also, people could learn about the
5 program through our website.

6 The process is, you know, a fleet
7 selects an eligible vehicle. They can find those
8 eligible vehicles on the website. They work with an
9 eligible vendor. The vendor submits the voucher
10 request form.

11 And this is an important process
12 here. So we use dealers, truck dealers, to run the
13 program. We don't want customers, fleet customers,
14 to have to bone up and learn how to run this
15 relatively complex program. So we have truck dealers
16 who do these deals, deal after deal after deal. They
17 learn how it works, and they can guide a customer
18 through the process.

19 So the voucher is actually paid to
20 the vendor, the truck dealer. So what happens is --
21 let's take a hypothetical example. There's a
22 \$150,000 truck. It gets a \$50,000 incentive. That

1 truck, the purchaser, the fleet only has to come up
2 with \$100,000 down. The truck dealer can sell the
3 truck for \$50,000 less. At the same time, the
4 purchaser pays \$100,000, we pay the truck dealer
5 \$50,000.

6 So the truck dealer gets his complete
7 \$150,000, but the customer only had to come up with a
8 \$100,000 up front. They don't wait around for a
9 rebate. They don't wait around for a tax return.
10 It's a really efficient way of getting a lower cost
11 vehicle into the hands of fleets.

12 So we came up with a menu of
13 different incentive amounts which really varied by
14 increasing weight of vehicle as well as the different
15 technology types. So zero emission vehicles get more
16 money; hybrid trucks get less money.

17 So how did we end up? Here's a
18 summary of the 288 trucks and buses that we offered
19 incentives for here in the Chicago area. You'll see
20 that it's a mix -- a really nice mix of pure battery
21 electric buses, pure battery electric trucks, some
22 plug-in hybrid trucks, hybrid electric trucks. By

1 the way, the distinction there is a plug-in hybrid
2 truck is a hybrid truck that also has energy storage
3 where you can plug in overnight and get even more use
4 out of that vehicle.

5 Hybrid electric doesn't plug in, but
6 it is more efficient than a conventional truck.

7 A hydraulic hybrid truck was an
8 interesting technology that has kind of waned
9 recently where instead of using batteries to store
10 energy, it actually used physical pneumatic tubes
11 that would absorb a charge of pressurized air and
12 then release it upon acceleration.

13 And finally, EPTO, that's an electric
14 power take-off. These are bucket trucks that ComEd
15 and other utilities would use, and instead of idling
16 a diesel engine while they work on power lines, they
17 have a battery bank that runs the boom. So that
18 truck can be working on a power line all day long,
19 and the diesel engine stays off. It uses battery
20 power to maneuver the boom while it's in use.

21 So there is future funding lined up.
22 Good news and some bad news. 21 million dollars of

1 CMAQ money has been approved to CDOT. However, we
2 are awaiting the approval of a Buy America Waiver
3 from the FHWA. FHWA has not issued any of these
4 waivers for any of the requests that have come in
5 since the new administration took office in January
6 of 2017.

7 There is an overall FHWA policy which
8 requires that the use of CMAQ funding use
9 American-made steel. They are sticking to their
10 guns and requiring that all vehicles purchased under
11 this program must be made of 100 percent American
12 steel.

13 There is no vehicle made today that
14 has 100 percent American steel, and historically,
15 through every other presidency, they have granted
16 waivers that say that instead of that law that's
17 written in the books, you can simply check that the
18 vehicle is made in America, and that would count.
19 The current administration is not offering that. So
20 they're sticking to their guns.

21 We're not sure when we're going to
22 see these waivers issued. There is a growing

1 political pressure from -- this is an issue that
2 affects the entire country. Chicago is caught up in
3 this just like every other community around the
4 country, and there are members of the house of
5 representatives who have an election this November
6 who are all clamoring for this public funding. It's
7 funding that's been approved. It just can't be
8 spent. So there's hope that something happens here.

9 Now, in my last few minutes I'm going
10 to offer some observations. In addition to
11 administering Drive Clean Truck, we also administer
12 California HVIP. And this is a relatively large
13 incentive program in California. We have issued 1300
14 incentives for pure electric trucks and buses in
15 California to date, and some of the interesting
16 things that we've seen recently are the growing mix
17 of DC fast charging as part of -- especially on the
18 truck side. We're seeing fleets that are choosing to
19 blend both Level 2 charging and DC fast charging to
20 give them some options on charging.

21 And these are not in all cases the
22 really high-powered DC fast charging much like the

1 Tesla superchargers. These could be even in the 20,
2 40, 60 kilowatt range of DC fast charging, which is a
3 smaller energy, a smaller power load than is, let's
4 say, the Tesla supercharger.

5 What's bringing this about is, as was
6 mentioned earlier today, as battery costs go down,
7 truck suppliers are able to provide larger and larger
8 battery packs, which gives fleets the opportunity to
9 have longer driving ranges. With those longer
10 driving ranges, they have to have more power to
11 recharge when they recharge these vehicles.

12 We're starting to see it pushing the
13 boundaries of Level 2 charging. So we're starting to
14 see a mix of Level 2 and DC fast charging, because
15 not every truck is operated in the same way. And so
16 we see that those trucks that may not go close to the
17 full battery load, you can get away with Level 2
18 charging. But we're also seeing that some of those
19 trucks that are getting close, they need DC fast
20 charging.

21 This is not opportunity charging that
22 you may normally think of for DC fast charging. This

1 is overnight charging, but a much larger battery
2 pack that really requires something more than just
3 Level 2.

4 So it's just an interesting
5 phenomenon that we're starting to see, especially on
6 the truck side, where we're seeing more DC fast
7 charging coming in, but it's being deployed at depots
8 where they're charged overnight. So it's not
9 necessarily out -- looking at fast charge opportunity
10 charging out by highways, but this is back at the
11 depot.

12 Disadvantaged communities. This is a
13 good sign coming out of California. Of all of the
14 incentives we've been given so far, 65 percent of
15 these battery electric vehicles are deployed in the
16 25 percent of California that has the worst air
17 pollution. So that's exactly the result that we want
18 to see.

19 And it really has more to do with
20 where trucks go. Trucks tend to go to more dirty
21 places in the state. So I think you can probably see
22 similar results here. This is the data that we've

1 found so far in California, but we found that pretty
2 promising so far.

3 Thank you very much.

4 MS. RITTA MERZA: Thank you very much, Tom.

5 Unfortunately, something came up, and
6 Phil was not able to join us today. So we will move
7 into our questions portion of the day, and I'll open
8 it up to the Chairman and Commissioners if they have
9 any questions for this panel.

10 (No response.)

11 MS. RITTA MERZA: All right. I have a
12 couple of questions.

13 As we slowly move towards
14 transportation electrification, how do you think the
15 job market will change and where will the jobs go?
16 And this question is open to anyone.

17 MR. ROB KELTER: Well, this is sort of a
18 funny answer, because I think what you're expecting
19 me to say is the jobs are going to explode, and we're
20 going to get all these jobs. But the truth is that
21 electric vehicles are much lower maintenance than gas
22 and diesel-powered vehicles. So one of the

1 advantages is you need less people to do the
2 maintenance and that means lower costs.

3 So I think there will be a lot of
4 jobs in producing electric vehicles, but in terms of
5 the maintenance of the vehicles, there will be fewer,
6 and while fewer jobs is usually a bad thing, in this
7 case, it's a good thing.

8 MR. MATT STANBERRY: I'll just add that
9 you'll see some jobs shifting. We will see
10 maintenance requirements go down over time. I mean,
11 we can't really separate the electric trend from the
12 autonomous trend and the shared trend.

13 As the spaces are expanding, we're
14 seeing different kinds of employment come up. So you
15 have many more folks employed in, obviously,
16 designing new vehicles, but you also have folks
17 running transportation network companies. You have
18 folks doing a lot more software work figuring out
19 charging patterns, but also usage patterns, ride
20 share pickup patterns. So there's a shifting that's
21 going to happen in employment as well.

22 MS. RITTA MERZA: Commissioner Trombold,

1 you mentioned that in developing Power Forward and
2 your other programs, you looked at other states and
3 what they were doing. What other states did you look
4 at?

5 And this is open to the whole panel.
6 What are specific programs -- and I know you
7 mentioned some of them during your presentations, but
8 what are some programs that stand out that you think
9 are good models for other states?

10 MS. KATE TOMFORD: When we began designing
11 Power Forward, we looked at, I think, about seven
12 different states. Clearly, California and New York
13 were out there as far as having had a lot of exposure
14 to grid modernization and discussions.

15 We also looked at Minnesota, DC,
16 Maryland, and I believe Arizona as well, just to get
17 a variety. So I had a cross section of staff, about
18 15 across our agency, that I led our staff team, and
19 each of them dove into what those states did and
20 how -- what we liked and what maybe we wouldn't do in
21 Ohio as far as modeling what we were going to do for
22 Power Forward.

1 And we didn't specifically look at
2 EVs during that time, I will tell you. We mostly
3 looked at the structure of how they had their
4 discussion as well as the policies that they came up
5 with. And what we found was having these
6 concentrated periods of time or phases, like we
7 called them, was a great way to be able to focus on
8 issues and then step back, meet with more people,
9 then focus again and keep building your knowledge
10 base.

11 And then afterwards, once we came up
12 with the ideas of what the policies or roadmap would
13 be for Ohio, we wanted to issue this report. And in
14 this report, we wanted to create these extra groups
15 that would start figuring out ways for Ohio to move
16 forward in actually implementing the policies. So we
17 wanted to have those goals and objectives already
18 laid out for the groups before that process took
19 place.

20 So that was how we decided to best
21 approach the Power Forward and looking at what other
22 states did.

1 MR. ROB KELTER: I will say this, I think
2 what we came up with -- first of all, I thought the
3 Power Forward report did a very nice job of
4 addressing this issue, and I'm glad to know that
5 we're going to get started on a working group soon.

6 But I think the AEP pilot is actually
7 a good pilot. We ended up with a really positive
8 start, and we'll, in fact, see how competition
9 develops in the charging station market.

10 MR. MATT STANBERRY: I think Commissioner
11 Trombold laid out pretty well some of the states. I
12 mean, Ohio and Michigan are laying out interesting
13 models right now for working the space.

14 As I was saying, there are a number
15 of states getting into the game, if you will.
16 Vermont just opened up their technical conference up
17 there overarching -- they're taking everything, all
18 of the regulatory matters into their open hearings.
19 New York's got theirs open now on EVs.

20 And, in fact, speaking to all of my
21 colleagues in the room, everybody getting their
22 comments in by Friday?

1 But again, they have asked 14
2 questions across-the-board on regulatory matters. So
3 there are more and more states trying to innovate in
4 this space.

5 MS. RITTA MERZA: I have one last question,
6 but I want to see if there's any questions from the
7 audience.

8 (No response.)

9 MS. RITTA MERZA: So my last question is,
10 we spoke a little bit about incentives, and I was
11 wondering whether non-EV driving customers would be
12 burdened by monetary incentives for transportation
13 electrification, and if so, how can we minimize their
14 burden.

15 And along the same lines, is there a
16 different effect for incentives that are offered
17 towards upfront costs, and incentives that are
18 offered for developing charging infrastructure, for
19 example.

20 MR. TOM BROTHERTON: So in incentives, two
21 general buckets of incentives, one for vehicles,
22 themselves, and another might be for infrastructure.

1 So for vehicles, here in the Chicago
2 program, it was funded by CMAQ money. So that's not
3 so much a rate-based pool of money.

4 Likewise, in California, the HVIP
5 program is funded by cap and trade revenues which are
6 generated within the state of California. So that,
7 too, is not necessarily coming out of ratepayers
8 funding.

9 Now, if you're talking about
10 incentives for infrastructure, once again, I think
11 there's a distinction between incentives and then
12 also allowing utilities to build out or at least rate
13 base, in some instances, infrastructure.

14 So we do have incentives for
15 infrastructure in California that are tied to vehicle
16 vouchers. An example of that is for every electric
17 vehicle that you get an incentive, a vehicle
18 incentive, tied to that is up to \$30,000 that can be
19 used for EVSE, the charging equipment, that would go
20 to actually supporting charging that vehicle.

21 What's not allowed as part of that
22 funding is the utility work that is oftentimes even

1 more expensive than the EVSE piece of equipment,
2 itself. So that is not part of this. But sometimes
3 you can link a vehicle incentive along with an
4 infrastructure incentive, but it really helps if
5 there's a utility program that can help the
6 utility provide what is sometimes a more substantial
7 cost.

8 And I will mention, too, that part of
9 this mix in forward thinking is starting to look at
10 building codes and ordinances that might require the
11 build-out or at least providing for the future
12 provision of electric charging infrastructure
13 wherever there are parking places that are allowed
14 within a design plan.

15 So it's not too soon to start
16 thinking ahead to how to at least set up a future
17 successful implementation of charging infrastructure.
18 Because what we have learned is that little charger,
19 itself, can be a small piece of the overall cost of
20 providing charging infrastructure. Sometimes the
21 utility costs, things like cutting holes in concrete
22 walls, trenching, those can be very expensive costs

1 that maybe if a building and parking structure is
2 designed right from the beginning, you can lower the
3 potential cost of adding charging later on.

4 MR. ROB KELTER: I was just going to add
5 real briefly. I think that right now sales are
6 dropping in a lot of places because of energy
7 efficiency. Those fixed utility costs are being
8 spread across fewer kilowatt hours, which drives the
9 actual price up, and having more customers using
10 kilowatt hours will help keep the cost of the grid
11 down and, also, you know, we've got a lot of very
12 inexpensive power that can be used if customers are
13 charging at night.

14 And then the electric vehicle school
15 buses are a really good example of benefits to the
16 grid and the level of power at peak that can be
17 provided at very low cost.

18 COMMISSIONER TROMBOLD: Just from a
19 regulator prospective, in Ohio, we believe that the
20 EV adoption should occur in a competitive
21 marketplace, but having said that, during
22 Power Forward, we had a host of panelists with EVs,

1 and I don't know if it was Phil Jones or somebody
2 else, but does anyone know what the reason is why you
3 would buy an EV. What's the biggest predictor of
4 whether or not you're going to buy an EV vehicle?
5 Does anyone know?

6 A VOICE: College educated.

7 COMMISSIONER BETH TROMBOLD: See, these are
8 all the things that I thought of, too. They said HOV
9 lanes, college educated. Anything else?

10 What we were told was, if your
11 neighbor owns an EV.

12 (Laughter.)

13 COMMISSIONER BETH TROMBOLD: So if you
14 think about it, you talk to your neighbor. You see
15 the experience they're having. You start feeling
16 more comfortable with the way they're operating it.
17 Then all of a sudden, the whole street buys EVs.

18 Then guess what happens? That
19 distribution gets very, very saturated and needs
20 upgrades possibly. And so that's where as a
21 regulator, I feel like we have to be aware of that
22 type of thing and why infrastructure upgrades

1 associated with EV is something that we're
2 considering and have been considering as being
3 something we should subsidize for a period of time or
4 allow for in rates or a rider.

5 MR. ROB KELTER: I can't wait until we have
6 those problems.

7 MS. RITTA MERZA: Commissioner Rosales?

8 COMMISSIONER ROSALES: Yes, quickly.

9 Tom, you kind of made a comment that
10 I guess I'll push back on, was trucks go to dirty
11 places. And logistically, I mean, you want that type
12 of business to be located -- you want your business
13 as a trucking business to be located close to where
14 you're going to travel. You could be in Crete or
15 Huntley, and it's much -- you know, it's less sparse,
16 but the travel costs of your business are going to be
17 increased. So you don't want to be, you know, in an
18 area that your accounts are at.

19 So I'm not sure where you're coming
20 from, because from a city perspective, Chicago, you
21 want those businesses to thrive, and to do so, the
22 businesses that have the trucking are going to be --

1 want to be as close as possible, you know, to those
2 places. So I'm not sure where you were coming
3 from.

4 MR. TOM BROTHERTON: So really what I'm
5 getting at is, don't forget what makes places dirty,
6 what causes air pollution is trucking. So if you
7 have a heavy concentration of trucking, that's where
8 we have bad air pollution.

9 And what we're doing is switching out
10 diesel trucks for electric trucks. What we found in
11 California is about two of every three electric
12 trucks go into a place that already has bad air
13 pollution, and that's good, because that electric
14 truck is being placed in a place where it's going to
15 make the most difference.

16 That's really the point I was making
17 is that when you're placing an electric truck, it's
18 just not going anywhere. It's usually going where a
19 diesel truck was. So you're really solving a local
20 air pollution problem.

21 COMMISSIONER ROSALES: Very good. Thank
22 you.

1 MS. RITTA MERZA: Did we have any questions
2 from the audience?

3 MS. CRYSTAL SIMS: Sure. So it's Crystal
4 Sims from Ameren Illinois.

5 I just have a quick question from the
6 Chairman's question earlier. Just thinking about the
7 energy efficiency policy in the state, and how now in
8 terms of economic development, we're almost trying to
9 unwind the way implementers and contractors have been
10 wound into that process over the last ten years, it
11 seems like a good opportunity from a policy
12 perspective to think about how the investments
13 related to electrification can benefit the
14 communities and how they can participate not just as
15 consumers, but also as participants in the economy
16 that will grow with this effort.

17 So I've wanted to hear from the
18 panelists, have you heard much about that throughout
19 the country or do any of your policies that you have
20 been advocating for reflect that?

21 MR. ROB KELTER: No. Seriously, I --

22 (Laughter.)

1 MR. ROB KELTER: I think there's been a lot
2 more discussion about other aspects of this than what
3 you raise, and part of it is -- well, I mean, I think
4 competition is just starting to develop, and we're
5 just starting to create jobs, so it's a good time to
6 have that conversation, but I wouldn't say that it's
7 really happened a lot yet.

8 I mean, I have been to a couple of
9 facilities where they build electric buses, for
10 instance, and they employ -- I don't know -- 20, 30
11 people. I mean, we're really just getting started.

12 MS. RITTA MERZA: All right. That is all
13 the time we have for questions.

14 On behalf of the Commission, I would
15 like to thank the presenters for educating us on the
16 current and potential legal and regulatory framework
17 for transportation electrification in Illinois and
18 across the U.S.

19 Please join me in a round of applause
20 for our panelists.

21 (Applause.)

22 ACTING COMMISSIONER PALIVOS: Thank you

1 very much for taking the time to join us today. I
2 know it's been a long day. We have been very
3 fortunate to hear from the experts in the field, and
4 I think it's safe to say that we learned a lot in a
5 short amount of time.

6 It's important to me and my
7 colleagues to continue to education each other and be
8 catalysts of change in this industry. I ask as we
9 leave here today, we continue to think about ways to
10 create a more stable and reliable electric grid, how
11 we can encourage and incentivize clean air and energy
12 efficiency and consider increased transportation
13 electrification as part of that puzzle.

14 This meeting stands adjourned.

15 Thank you.

16 (Applause.)

17 (WHEREUPON, the meeting was
18 adjourned.)

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